ELECTRICAL REVIEW

[ILLUSTRATED.]

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A Telephone Exchange System.

January 16, 1880, Leroy B. Firman, of Chicago, filed an application in the patent office for an invention of a "telephone-exchange system and apparatus," assigning the same to the Western Electric Company. October 13, 1885, this patent was granted, the application having been before the patent office for nearly six years, indicating that there had been considerable history connected with the granting of the patent, and that numerous interferences had shown up. After a six-years' struggle, Mr. Firman and the Western Electric Company come out ahead, and secured a patent on a system that, judging from the claims in the patent papers, covers the well known Law system. We illustrate the system on this page. Claims three and five are as follows, and will give our readers an excellent idea of what the patent covers:

The combination of signal-transmitting instruments at different sub-stations and a common receiving-instrument at a central station upon one circuit with a telephone at each sub-station upon an independent circuit extending thence to the central station, a telephone at the central station, and connecting wires or switches by which said telephones may be connected at will with any one of said independent sub-station circuits.

The combination of telephones at different sub-stations (each in an independent circuit extending from the central station to the said sub-stations, which circuit is grounded at the sub-station and open at the central station) with a telephone at the central station in a normally-open earth-circuit, and connecting wires or switches by which said open earth-wire may be connected at will with either or both of the said independent wires, so as to form a closed circuit.

The Electric Light in Photography.

Photography, with the electric light for the source of illumination, is becoming more extended in its applications every year, and many of our city photographers are now supplied with electric plants, and make daily use of it. Thus the luxury of the yesterday becomes the necessity of to day.

Yet all has not been plain sailing in this matter and many knotty problems have arisen which had to be met and overcome. The arc light, as is well known, is rich in the ultra-violet rays of the spectrum which with the ordinary appurtenances of photography by solar light are but little effective in chemical action owing to the great difference in their refrangibility from that of those lower in the spectrum—the reds and yellows. This causes in the ordinary lens a reflection which, giving a white light fogs the plate and thus renders the ultra-violet rays ineffective. But recent experiments of Capt. Abney described before the Society of Arts have demonstrated by aid of the spectroscope that the use of a quartz lens instead of one of glass, obviates this difficulty as it permits these rays to pass equally with the reds and yellows. Photography has long been a source of comfort and pleasure to all but the rogue, and as an aid to scientific research and record it is fast becoming invaluable. With its new ally the electric light a new field is opened up and its possibilities greatly enhanced.

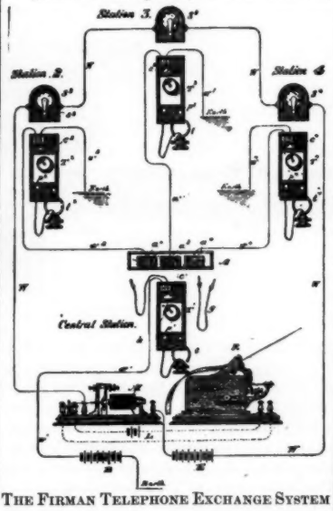
New York Electrical Subway Commission.

LAST DAY'S PROCEEDINGS—ADDRESSES OF PROF. ELISHA GRAY AND OTHERS.

Thursday of last week was the day set by the Electrical Subway Commission to conclude their labors as listeners to the plans for placing wires under ground. The room where the Commissioners were sitting was crowded, a number of inventors with their attorneys being present. The electrical and daily press of the city was represented.

The first speaker after the introductory remarks of Mr. Dorsett was Prof. Elisha Gray, and knowing the interest with which the remarks of so eminent an electrician will be received, we publish his remarks, as well as the discussion which followed:

Mr. Dorsett—"*Gentlemen of the Commission:* In coming before you at this time to present this system, I will first call



THE FIRMAN TELEPHONE EXCHANGE SYSTEM

your attention to the material of which it is composed, giving to some extent a history of it, which dates back to the fall of 1873. I at that time attempted and succeeded in constructing some service work in the way of sidewalks, using a material composed of coal-tar, sand, gravel and other materials, which up to the present time has proved very successful. From that time until the fall of the year 1877 I gave very little attention to it, but since 1877 I have given my entire time and attention to the production of a material which would prove durable for sewerage construction. The first work of importance I engaged in after I succeeded in securing this material which you see before you, out of which my conduits with some few modifications are largely made, was the construction of a sewer at the Iowa State Penitentiary at Anamosa, where I put in over 6,000 feet of 12-inch pipe. My next work was in Chicago in the following year—1881–'82. In the fall of 1881 I constructed sewers for the Lincoln Park Board of Commissioners. In the spring of 1883, Professor Barrett, city electrician of Chicago, came to my office and asked me if I would like to have my material tested as an insulator. I told him he might do so, and I broke off a piece of sewer-pipe in my office, and he made some tests with it and pronounced it as good an insulator as he had ever found, and from that time recommended it for the work that it is now being largely used for, and a year ago last spring having succeeded in getting an appropriation for underground work for the city from the city fathers of Chicago, he contracted with me to put up for him this material in the shape of a pipe. Those pipes were made nine inches and six inches in diameter, the trunk lines being nine inches, the laterals 6. I commenced the construction in the early spring of 1884. In July following he commenced drawing in his wires which were single Kerite wires, drawing ten and twenty of them half a mile at a time—even twenty different wires without abrasion. Those wires have been in operation twelve to fifteen months without any cost for repairs to the city or any disturbance of any kind whatever, so much so that in the system which I constructed the past year for the Chicago Sectional Electrical Underground Company, Professor Elisha Gray, president, the city has rented a duct all over the south side, and the wires are now in operation in those ducts. While constructing the system for the city, Professor Gray's attention was called to it, and it was at that time I became acquainted with him. He had then invested a large amount of money in trying to find a successful system, and succeeded in finally getting a franchise which would enable him to put in a comprehensive system for the entire city. We have more or less of the ducts filled with all classes of wires. There are fourteen miles of single seven-hole conduits, covering over about ten miles of street. It is laid—a great deal of it—double, separating the electric light and the telegraph and telephone systems from each other."

Commissioner Hess—"One conduit?"

Mr. Dorsett—"Two conduits separated by about six inches of earth. One is devoted entirely to heavy circuits such as electric light and power; the other to telegraph and telephone circuits. They are, however, united largely in the man-holes, all kinds passing through the same man holes at the intersection of the streets. In connection with this subject I would like to spread out the maps showing the system that we have there, and also the extent of its construction."

(Mr. Dorsett exhibited two maps).

"In Chicago we have the areas or sidewalk vaults which belong to the city, the city owning the entire breadth of the street from building line to building line, and under the franchise we have the use of these areas."

Commissioner Hess—"Where are these pipes laid?"

Mr. Dorsett—"Right along the street, having the same relative position in the street as they have on that paper, the sewer coming in the center. We get outside the water pipes as we are outside the gas. Our pipes are laid on an average about thirty inches deep to the bottom of the trench."

Commissioner Hess—"You don't have them on both sides of the street?"

Mr. Dorsett—"No; the amount of work which has been done in Chicago I can show by this map."

(Mr. Dorsett laid before the Commissioners another map).

"These white lines show the extent of the system. We have covered the entire south side as far as Harrison street. This portion of the city is covered so that we reach every block with these laterals. On the north side we have simply run a double line up to Lincoln Park two miles, and on the west side going over the river."

Commissioner Hess—"Have you an aerial system at all?"

Mr. Dorsett—"No; but we have areas that take care of the entire system. In these conduits are the wires of the Chicago Telephone Company, Postal Telegraph, Western Electric Company, Thomson-Houston, the Mather, the Fuller, the Badger, and the Sperry Electric Light Companies, the Mercurial Fire Alarm Company, the Gold and Stock Indicator Companies, besides the telephone and telegraph wires belonging to the Police and Fire departments. My system consists of one or more multitubular conduits, with man-holes at convenient distances; it is essentially a drawing in and out system. Its chief merit, perhaps, lies in the material of which it is composed. It is a non-metallic material, which underground is indestructible; it is cheap; it is capable of being moulded into any shape, and it has high insulating properties. It is what is known in chemistry as a neutral substance; it is impervious to water or moisture or sewage. It is impervious to illuminating gas, and sewer gas. It is unaffected by the action of acids or alkalies. It cannot rust; it becomes harder with age. Unlike metals, it is incapable of expansion or contraction by heat or frost. It may be classed amongst the asphaltum concretes, but, unlike the street pavements and sidewalks, and other forms of asphaltum concretes, it is unaffected by the elements, and does not deteriorate through exposure or age. It is the one form of this concrete in a thousand that is a success, and this is largely due to the oxide of manganese in its composition, which appears to be the bond between the other elements in its composition, and yet it is a material which, though the ingredients in their proper proportions are given, it requires a peculiar method of admixture to make the compound perfect. I would like to ask Professor Gray to talk a little to you now, and after that I will present the system as I have adapted it to the city of New York to the best of my ability."

Prof. Gray—"*Gentlemen of the Commission:* I do not know that it is necessary for me to add very much to what Mr. Dorsett has already stated. He naturally wants me to say a few words inasmuch as I have been the means of putting this system down, as far as it is put down, in the city of Chicago, and naturally in doing that we have had some little experience. As he stated a while ago, I have spent considerable time and considerable money in studying up this question of underground service for electric wires. It is not a question there and I don't suppose it is a question here between the relative merits of the overground and underground service, inasmuch as the decision there was to go underground anyhow. The next question came up, how best to go underground. There is no system of telegraphic service, either underground or overground or under the sea, that is free from all objections, and perhaps all systems have some advantages. They all have disadvantages—some of them more than others. The best thing we can do is to get a system that, in our judgment will present the fewest

difficulties in accomplishing the work. It is not wholly an electrical question; it is largely a mechanical one, and yet the electrical side of the question must not be lost sight of. After studying the problem my conclusion was that I would prefer a large sewer big enough to drive a four-horse team through, that we could get in and string our wires around the sides of it; large enough to take care of all the wires—but that was impracticable in Chicago; I don't know whether it is in New York or not. It may be from a pecuniary standpoint, if from no other; but there it would get so far down below the lake—some ten or fifteen feet, because we have to go about twenty five feet down to get clear of water pipes, and gas pipes, and all sorts of pipes that are now in the streets, and I assume that that would be the case in any large city. Besides, it would cost millions—a great many millions—to build such a system.

"Throwing that aside as impracticable, so far as we are concerned at least, the question came, what comes next? I concluded from my experience as a telegraph man, which dates a long way back of this conduit, that it would not be safe to place any wire underground, or in any position out of reach of repairs.

"Modern improvements in manufacturing wires, and insulating wires, and putting wires in position, are very great as compared with what they were even a few years ago; yet it is not safe to conclude that a great system which has cost a great amount of money can be put in any position that cannot be readily and easily gotten at.

"So then, the next question was to devise something or adopt something that would enable us readily not only to put in wires as

required, but to take them out, if necessary. That was the first great fundamental feature of the system, and, as Mr. Dorsett has explained, we have in Chicago adopted what we would call the drawing in and out system; that is, we have provided a conduit, or rather a series of conduits, or a conduit with a series of ducts connected with manholes. I think the average distance in Chicago is four hundred feet. We can draw six hundred feet very comfortably of any cable that would fill one of these ducts, as we have frequently drawn through one man-hole, two lengths, say eight hundred feet. It would depend, of course, on the weight of the cable and other things, but we have a system of drawing in and out machinery for shoving through and catching on to a wire or rope, or whatever we need to handle the cable, with which we shove through at a very rapid rate—perhaps as fast as a horse could trot—hook on to a wire and draw it back, and then hook on to it whatever we wish to draw through; and then by another machine which we employ, when a rope is hitched on to it the cable is drawn through very rapidly, so that I have claimed, and do claim, that the wires as they are now placed in our conduits are as readily gotten at—are as fully accessible as any wires overhead; and they are certainly far freer from any of the difficulties that are constantly happening to overhead wires; because if that wire is once placed in the conduit in a proper cable, properly insulated, it is a very rare thing that it will ever get into trouble. That is our experience from the use of wires now for over two years underground, more or less, in Chicago.

"I do not propose to go into the wire question at all. We have adopted a system like this: We run a conduit system, and let any man who wishes to put in wires, put whatever wires he pleases in there. He may adopt any form of insulation he has a mind to, or no insulation, as one man has done in a single instance, and finds it work very well; but, of course, we do not recommend that. We treat the conduit merely as a receptacle for wires, and we deliver them through streets and into every block. We have laterals running from the main man-holes at the corner of each street, running into the area ways of the various blocks in the city, and from that point the distribution is made for that particular block.

"Now, the question of distribution is one that may be varied, and that is one of the beauties of this system, that it can be adapted to any form of distribution that the circumstances of any particular city may require. Now, we say we have open area ways all around our blocks, and it is a very easy matter when you get into one block to carry a small pipe around under the sidewalks which will be large enough for that block only. No one block can contain a great many wires, so it is an easy matter to provide by a small conduit for distribution.

"Of course we could adopt another method and run a small conduit around every block, and with service wires through area ways. We say that it is not necessary to adopt that, as the other mode is better.

"Another mode is to run into the block and distribute over house tops, if you can make satisfactory arrangements with the owners of the property. Of course there is no objection to that if property owners do not object. In some instances they do that, in some blocks in Chicago, for the present, but finally it will come to this distribution system under the area ways, as I think that is the freest from difficulties, and the safest in every respect, and better for the owners of property undoubtedly.

"Our system aims to run down every other street, as you will see. By that means we can touch every block without running in every street, and then an occasional cross conduit cutting all of these through the other way just often enough. It is not necessary to put those through every other street, but every four or five blocks, just often enough to make it convenient to get from one side of the city to the other, and laterally if you want to do it. That is a question that is wholly determined by the need of any particular locality."

Commissioner Loew—"How large a conduit, have you, Professor, at any one place?"

Prof. Gray—"We have on La Salle street twenty-six ducts."

Commissioner Loew—"How large is that?"

Prof. Gray—"There we have a 10 duct conduit. There is a ten and a nineteen at points like that on Washington street at the tunnel, and La Salle street at the tunnel. Where all the wires must come in to cross the river, we make a larger conduit. We have nineteen holes."

Commissioner Loew—"How many wires are in that? How many will it carry?"

Prof. Gray—"It depends altogether what kind of a wire you are using. One of those ducts can carry four electric light wires, or 125 telephone wires, or 25 telegraph wires. It depends entirely on the thickness of the insulation that the party uses. Mr. Fay, General Manager of the Chicago Telephone Company, has some samples which have 125 wires that will go easily in one of those ducts for telephone purposes. I won't say that I recommend that many crowded together, but that is his business, not mine. The Western Electric cable, called the Patterson cable, is made of lead pipe, with paraffine insulation inside. With the size that they make that, the duct will only accommodate four. I am speaking now of electric-light wires. So it depends, as I say, upon what you are using wires for, and what the idea is of the man who uses them. I could get one thousand in one duct. You multiply that by the number in any one place, and it gives you the capacity. I have no doubt that there are a great many questions that some one that is well posted would like to ask on this subject. I probably might overlook points that ought to be brought out, but I would be very glad if any one has any question in his mind that he would ask it."

Commissioner Hess—"What is the strength of that?" (Pointing to section of conduit.)

Mr. Dorsett—"Five thousand five hundred pounds per square inch—crushing strain. The tensile strength averages about 400—about three times that of the best Portland cement concrete."

Prof. Gray—"One of the points in my mind in reference to this material, or anything of the same nature, is the ease with which it could be put in any shape that is desired. Those ducts can be made larger or smaller, as the demands of any particular locality would require. The same principle of operation would form it for one size as well as another, but the object of making the ducts that size was this: You cannot draw in and out wires that are piled on top of each other with any kind of success, if there are a great many of them. Suppose you had a six-inch pipe. Practically, you could not put many more wires in it than you could put in one or two of those ducts and handle them rightly; so that, to use the space economically, it must be divided into ducts about the size you can easily handle in one duct, and that is the object of the subdivision."

Commissioner Hess—"You say you can draw a cable five or six hundred feet through that without injury to the cable, without straining it."

Prof. Gray—"Oh, yes, we have done that. The interior of the duct is very smooth. It is moulded on a polished surface, and, as it is drawn out, it leaves it in practically a polished condition inside."

Mr. R. W. Pope—"You said there were four electric light wires in the duct. Did you mean that was all you could put in, or all that you did put in?"

Prof. Gray—"I mean that in drawing through they put four in a duct—the Western Electric Company. Of course, with a wire made smaller, with thinner insulation than they made, more could be put in."

Commissioner Hess—"What insulation do they use?"

Prof. Gray—"In this particular instance they use what is called the Patterson cable. It is made in a lead pipe. Of course, that lead pipe takes up a good deal of room, and the wire, which is a large wire to begin with, is surrounded by jute; then hot paraffine is injected into this lead pipe until it is filled. All those present who are familiar with electric-light wires understand what the Patterson cable is. There are various kinds of wire, of course, and some with thinner insulation than that, or rather others with no lead pipe, and which, of course, would occupy much less space."

Dr. Moses—"Do those wires go out at the man-holes?"

Prof. Gray—"Yes. At the corner of every street there is a man-hole, and from that man-hole there is what we call a lateral (indicating on the map). These conduits come along here. They all run into that same man-hole."

Dr. Moses—"How do you make your local distribution?"

Prof. Gray—"We leave that question to the wire-users. We deliver them in the block, and charge them so much for the space, or so much for the wire and the distance, and they arrange with the property owners. However, the matter now, as we have arranged to do it, is to control not only that, but to deliver the wires to every building by a small duct, which will run right around the block, so arranged that you can take out wires in any building."

Mr. McDonough—"What arrangement is there for drawing a lead armored cable through the duct, taking the spring out of it if it is rolled from the drum?"

Prof. Gray—"The cable is delivered on a drum. It stands up over the man-hole. Then there is a guide to start the thing. A man stands there and feeds it down and keeps it to the right curve. There is a capstan arrangement situated in the other man-hole opposite the duct, which may be the whole length of two blocks. If the cable is not too heavy we can draw two blocks very comfortably right through one man-hole."

Mr. McDonough—"Is that sufficient to make the cable perfectly true, and have it go in on the line without any spring at all?"

Prof. Gray—"A lead pipe, you know, has no spring on it. It stays where it is put. Of course as it goes in it is straightened. We experience no trouble whatever in practical work. We have put in certainly twenty miles of cable."

Mr. Dorsett—"Would not that be one of the advantages of a small duct?"

Prof. Gray—"Of course you could have the cable so large that it would not be manageable. Any cable that will go in that duct, very readily takes its shape as it goes in."

Mr. McDonough—"The contention I made was that coming into contact with the surface of this hole in the duct you would get up so much friction there that you would not be able to draw it through from man-hole to man-hole."

Prof. Gray—"The only answer I have to make to that is that we do it. This reminds me of the fellow in jail to whom his lawyer came and said, 'My dear fellow, they can't put you in jail.' 'But,' said the man, 'I *am* in jail.'"

Dr. Moses—"When you wish to make a distribution for one particular block do you use a special cable for that block?"

Prof. Gray—"We use whatever wire is needed at that time."

Dr. Moses—"Do you use the cable specially provided from a central station running from the main?"

Prof. Gray—"We take a wire out from the main at any point we want. Some people put in the single wires, you know. They can draw a bunch of wires through that duct, whatever it will hold, or a single wire, and in that case of course they have nothing to do but just divert that wire into any one of these blocks."

Dr. Moses—"Do you provide for the wants of each block as you reach it?"

Prof. Gray—"We provide the space. We do not provide the wires. We provide the conduit."

Dr. Moses—"I simply wish to know what the facilities may be for supply."

Mr. F. L. Pope—"Do you have any instance where a small pipe runs from the man-hole to the corner of the block, and different classes of wires are put into the same conduit, electric-light and telephone wires for instance, or do you provide two separate channels from the man-hole to the block?"

Prof. Gray—"In some instances there are two separate channels, but, in many instances there is only the single 7-hole conduit. That we do wherever it is desirable for any reason whatever to lay two sets of laterals. Otherwise we do not. We have that in some cases; in others we have not. We have conduits all over the city; most of them that size, and we keep all of the electric light wires in one, so far. That was the design to keep the electric-light and heavy-current wires of all sorts in that set of conduits."

Dr. Moses—"How far apart are they?"

Prof. Gray—"About six inches of earth between the two conduits."

Mr. Dorsett—"It would average about six inches."

Mr. F. L. Pope—"What are the usual methods adopted for making the jointings of the wires in the man-holes?"

Prof. Gray—"Well, in the Patterson cable, which is more used, perhaps, there than any other, whenever they take a wire out they have a mode of sealing the jointing up, and then it doesn't need any protection farther than the ordinary insulation."

Mr. F. L. Pope—"The joint is simply made in the wire, and then the insulating covering is replaced over it in some way?"

Prof. Gray—"Yes."

Dr. Moses—"Is there any delay when a service is asked for in a householder getting it?"

Prof. Gray—"There is no delay on our part. We have four or five electric-light companies in our conduits. Now, if a man wants a light it is the company's business to get a light to him, not ours. We charge for the use of the conduit. Then there is a ticker service. We rent them the space in the conduit and they get the wires to their customers. That is a part of the business we pay no attention to. Of course, if it were our business we would see that it was done, but we cannot be a conduit company, and a ticker company, and an electric-light company, and a telegraph company, and everything all at once; it is not practicable. The services must be divided up; and that divides it up very nicely."

Dr. Moses—"When you lease your conduits do you do it according to the diameters of the insulation or the diameters of the wires?"

Prof. Gray—"Where we wholesale it, we go by the space. Now to answer the question that you will ask me next—we own a certain number of wires for individuals. For instance you have a private wire. You want a single wire. You do not want to rent a whole duct. We take our chances on that and buy a cable and put it in ourselves. We rent you a wire and put it in your office, and wherever you want it from our own cable. We now have one cable in most of that south-side system; most of the cases are covered by the various companies, the electric light, the telephone, the telegraph, the American District and the ticker service, and all that are represented by companies, and it is their business to look after their own customers."

Commissioner Hess—"Do you guarantee the effective working of the wire?"

Prof. Gray—"Not at all, only so far as it is affected by the conduit."

Commissioner Hess—"I mean so far as it is affected by the conduit."

Prof. Gray—"We keep the conduit in order. If the conduit gets broken, or anything of that kind, it is our business to repair it."

Commissioner Hess—"Have you had any complaints as to the unsuccessful working of the conduit?"

Prof. Gray—"We have not."

Commissioner Hess—"How long have you been working it?"

Prof. Gray—"We began laying this system last fall. We have had wires underground there for the past two years. How long ago was it!" (To Mr. Dorsett).

Mr. Dorsett—"A year ago last spring."

Prof. Gray—"These wires have been working since that time. They have now adopted our conduit for the balance of the city. We began renting space as soon as we got the conduits down."

Mr. R. W. Pope—"Practically, Professor, how about the joints in these man-holes? Do many of the cables run through or are they joined up at the man-hole?"

Prof. Gray—"That depends upon the weight of the cable. They aim to draw as long a section as they can and not injure the cable, so as to have as few joints to make as possible. That is a mere matter of economy with them. With the Patterson cable for instance, they draw through two blocks without making a joint, but, if necessary, a joint is made in each man-hole. That is a practical question which comes up to the cable men and not to us."

Mr. R. W. Pope—"I wanted to know what the experience was, that was all."

Prof. Gray—"That is about it; in a great many instances they make a joint about every other man-hole, which means every other block."

Dr. Moses—"Have you a system of separate services in each one of these blocks?"

Prof. Gray—"No,"

Dr. Moses—"Have you had experience as to running electric-light circuits with telephone circuits?"

Prof. Gray—"I know the result of telephone and telegraph service when run near together. Of course, we all know that telephones are more easily affected than any other class of wire. There is no difficulty in working electric light and telegraph wires together. There is no difficulty in working electric-light wires and telegraph wires in the same conduit, if you will let me put the wires in and fix them as I want them. But as a precaution which any one would naturally take, we prefer to have all the heavy-current wires in a duct by themselves."

Commissioner Hess—"You claim you can run an electric-light and a telegraph wire in the same duct?"

Prof. Gray—"Oh, yes,"

Commissioner Hess—"Without injury to the electric light, I suppose?"

Prof. Gray—"Without any injury to either."

Mr. R. W. Pope—"Are there any wires using the Gray Harmonic system through the conduit?"

Prof. Gray—"Yes. The Harmonic system runs through the Postal cables, and I have worked telephones right inside of that. Of course, if they were exposed, and had no shields of any kind, practically you could not use your telephone at any great distance."

Dr. Moses—"Are the shields grounded?"

Prof. Gray—"Oh, yes, they lie right on the conduit, and, as that conduit is iron, they must be grounded very effectually."

A Gentleman—"In case there should be an explosion of a steam pipe or anything near the conduit, would that cause any trouble?"

Prof. Gray—"It is readily mended. It is the easiest kind of a system to mend in case of an accident."

The Gentleman—"In doing so, you would have to take out the cable."

Prof. Gray—"Not necessarily. You can make that in sections, and take one of those sections right out and put it together without disturbing the cables that are in there. It might be advisable in some cases, if you did not have it full—it might be easier to draw the cable out and draw it in again than it would be to put that conduit in in sections and join it up, but that is a question that I would settle at the time when the accident happened."

A Gentleman—"In Chicago you have area ways in which to lay your pipes. Now, I would like to know how you lay them in New York. Take it down in Wall street, take it in all the lower part of the city of New York—there are no areas there."

Prof. Gray—"Your distribution would either have to be from the distributing pipe in the street, around the block or over the house-tops, from the distributing point there."

Commissioner Hess—"Or a court-yard."

Prof. Gray—"Or court-yards. It is not limited to any one variety of distribution at all. It is a question that has to be settled in every city according to the circumstances you have to meet."

A Gentleman—"Take it where they would have to branch off parallel, 45° or around a corner across the street, how would you get there? In Chicago you have square corners, but New York doesn't have square corners."

Prof. Gray—"Your question is, Can you lay a conduit on a curved street? Why, there is a certain amount of curve that can be put into these pipes, if the curve is not too sharp, but I take it there is no street but that you can meet the objection in this way—you can lay your conduit as far as you can go straight or on a curve, and put a man-hole in there, and go off in the other direction."

A Gentleman—"How would you draw in your cable on a curve?"

Prof. Gray—"We would draw it in. Of course there is more friction on a curve than on a straight hole, though if the curve is down there is not. You could draw a cable that sagged down more easily with a curve than you could with a straight hole. If you were suspending a cable in mid-air it would have a curve."

A Gentleman—"Wouldn't you have trouble with moisture in such a trap as that?"

Prof. Gray—"I would not have that trap in it. I merely spoke of that for illustration. It would be better to drain toward the man-holes from the center."

Mr. F. L. Pope—"Your idea is that wherever the curve is too great to draw the cables conveniently, you put in an angle and a man-hole?"

Prof. Gray—"Yes, an angle and a man-hole."

Mr. F. L. Pope—"You have been to Boston, I suppose?"

Prof. Gray—"Well, I have. You can generally avoid a curve there by going through a narrow alley."

Mr. Geo. Worthington—"With the conduits, Professor, that you have described, has there been any trouble caused by sewer gas?"

Prof. Gray—"Not the slightest. The conduits are impervious to sewer gas."

Mr. Dorsett—"I would like to show my plan as I have adapted it for New York. The object of the Dorsett system is to facilitate the laying and distribution of the conductors throughout a city, or any part of the same, to the better insulation of said conductors, and the prevention of inductive or other injurious effects, arising from the close proximity of circuits for different purposes, such as telegraphing or telephoning on the one hand, and electric lighting on the other.

"The system is comprehensive and complete, in so far as it provides for the economical laying and working of all the circuits which the present needs of business and communication require; in other words, it provides for the running in close proximity of circuits for carrying the strongest and most intense currents, as well as those for carrying the most feeble electrical impulses such as are produced in the operations of telephony, and this in such manner that there will be no danger to any circuit from such proximity, while all are brought within ready and easy access.

"The system comprises main and branch pipes, or conduits, in which the conductors are carried in the manner hereinafter specified. The main consists of three separate and independent pipe lines; one containing such wires as are required for communication with distant points, or other cities, and which are designated as trunk lines; another pipe contains the wires of circuits used in local communication, and intercommunications, such as telephone lines, fire and burglar-alarm circuits, and the like; while the third contains the circuits used for electric lighting, transmission of power, or those industrial and domestic applications of electricity which require powerful currents.

"The lines are run through the streets of a city, at such a distance below the surface as will insure protection against bending or injuries from repair of the streets, subsidence of the surface soil, and the like. Generally, and whenever convenient, the lines are run midway between the buildings on either side of the way, and with the trunk line between the other two.

"At the intersections of the streets the three lines are run into what are termed man-holes—that is, subterranean chambers large enough to permit a man to enter them for obtaining access to the pipes, or conductors, therein. These man-holes are constructed in a way to keep out water, moisture, moist air, sewage, illuminating and sewer gases, and other matter, and are provided with suitable detachable double covers. The pipes pass through their sides, and the wires can be carried from one pipe to another, as may be required.

"Between the man-holes, and along the blocks, or squares, are numerous subterranean chambers, which are called, or designated, as hand-holes. These are placed as nearly practicable opposite the dividing lines, between the buildings, so that in places where the buildings are of about the same frontage two hand-holes are required for each group of four houses, as will shortly be explained.

"The hand-holes are for the purpose of running branches from the two pipe lines, on either side of the trunk line, which latter does not pass through them. They are much smaller than the man-holes, though constructed on the same principle. The pipes containing the signaling, and those with the electric-light wires, enter these boxes, and one or more of the wires or branches from the same are brought up to a higher level, and taken off into smaller branch pipes to the buildings. Four of the smaller pipes run from each hand-hole, one to each of the four nearest buildings, and in laying the hand-holes and branches it is desirable to locate the former as near as possible to each other in order that all the branches may be placed in laying in one small trench. Of the two branch pipes that run to each house, therefore, one contains the wires of an electric-light circuit, the other those of a telephone or other signaling circuit. In the case of the former there may be one or more leading and return wires for the same house-circuit, or the leading wire or wires to one house, and the return wire or wires from another. This is obviously a matter of choice, and not essential to the main features, that of isolating the electric-light circuit from the others.

"The material is an insulating compound, containing coal tar, paraffine, silicious sand, pulverized ashes and cinders, oxide of manganese, and ammonium chloride, in certain proportions.

"This material I use for the mains of my system, preferring it to all others. The joints between the sections of the pipes may be either of metal, or the entire conduit may be made from the insulating material alone. I make the man-holes of this material also. The hand-holes are also made of this material.

"Inasmuch as the mains are buried deep, and are of comparatively large size, they are advantageously made of the insulating compound alone, but it is extremely undesirable to bury the branch pipes deep, in fact they should be but little below the surface or flagging of the street, and as they carry, usually, only one or two wires, they should be made quite small. Instead of making them, therefore, of the compound alone, I use iron pipes which are filled with the compound, through which passages are formed for the wires. By this means the requisite strength and insulation are obtained.

"That section is exactly a duplicate of what we make. The sections are made in my

(*Continued on sixth page.*)

Electrical Review.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

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CONTENTS.

	PAGE
Firman Telephone Exchange System	1
The Electric Light in Photography	1
New York Electrical Subway Commission	1-3,6-9
Editorial Notes	4
Incandescent Lighting Companies' Success	4
Electricity Direct from Coal	4
Another Application for a Suit to Test the Validity of the Bell Patent	4
General Western News	5
Telephonic News	6
Telegraphic	7
Electrical and Scientific	8
Telephone Business in Nebraska	9
South American Telephone Business	9
Electric Light News	9
Electrical Patents	10

The American Bell Telephone Company has declared an extra dividend of $2.00 per share, payable November 15.

We call attention to the very interesting remarks of Prof. Elisha Gray, on underground conduit systems, which appear in another column.

The central telephone station of the Bell Company, 413 Olive street, St. Louis, caught fire Tuesday night, but the flames were controlled within thirty minutes after their discovery. The fifth floor, which is used as the operating room, was completely gutted. The loss to the Telephone Company will not exceed $5,000, which is covered by insurance. The fire burned away the cupola before it was discovered.

We hear that the managers of the Erie Telephone Company at Lowell are likely to get all the law they can attend to before they finish with the former management. The company is likely to be sued for salaries and expenses for some two or three years for which the former managers have never received anything, and this sum, it is said, will amount to $25,000 or $30,000.

Many Erie stockholders are questioning the policy which the new managers have pursued; they claim that the price of their stock has been injured by these suits, and that with a prospect of long expensive litigation no one cares to invest. We hear that a large number of stockholders are about starting a movement to inquire into the reason for the proposed litigation, and whether it is done in the interest of the stockholders, or for personal reasons. More attention to the business and less law is evidently needed to make the stock bring anywhere near its value.

The New England Telephone Company's, troubles still continue. The rise in rates is causing the return of many instruments. Several exchanges will have to be closed, and many others will be greatly reduced in numbers. Concord, N H., St. Johnsbury, Vt, Holyoke, Mass., Lawrence, Mass., Augusta, Maine, and other places will or have lost over half their list. To keep those left satisfied, at an advanced price, will be a hard task.

The service is likely to become another cause of trouble if the policy of discharging old, experienced line and trouble men and putting in their places green boys is pursued.

We may show our readers next week that the rise in prices throughout New England is wholly attributable to the American Bell Company, who receive nearly the entire benefit derived.

The REVIEW presents its readers a very complete story of what is claimed by gentlemen of experience, more or less, in placing wires underground. Three leading systems are described, the Dorsett Conduit, the Okonite and the Standard Underground Cable Company. The first-named does not deal with the wire and cable question, it only provides a receptacle for them, and that it has proven a practical success is shown in the remarks of Prof. Elisha Gray, who has expended probably $250,000 in the work in Chicago. The Okonite Company present a new system of cables for underground work which can be used without the aid of conduits, and the Standard Company, using the well-known Waring cable, gives a history of its work. Each system we illustrate, and from our pages this week the reader, who is at all interested in this new problem to be met by the electrical companies, will find the latest data concern the underground question. The New York Subway Commission now has the matter before it, and will render a decision as soon as certain cities where the underground systems are in operation have been visited and the work investigated.

SUCCESS OF THE INCANDESCENT LIGHTING COMPANIES.

Of all the progress made in the electrical field of recent years, the work in incandescent lighting that of the Weston, of the Brush-Swan and the Sawyer-Mann companies is at once the most pronounced and gratifying. Beginning, as they all did, under most unfavorable conditions, with a public uninformed as to the advantages of incandescent lighting, and a greedy and slow-going rival to fight, they struggled on, step by step, until now they have beaten away the obstacles that stood in their path, and by sheer superiority of apparatus and straightforward business methods forced their way to the front.

They began their work modestly, making no rash promises that could not be realized, and leaving prediction and prophesy for the prophets. When they found they could get a certain number of incandescent lights with a certain horse-power, they offered to take contracts to do this and no more, and thus, keeping within the bounds of practical feasibility, they performed what they promised, and got a reputation for consistency and thoroughness which has remained to them to this day.

It is curious to look back upon the struggles of these companies, and watch them as they improved their processes, while, at the same time, beating back what was then a powerful rival, but has grown weaker and weaker as they have advanced. The United States and the Swan companies had many a tussle with this rival concern. The latter company bested it so thoroughly in England that its growl has sunk to a plaintive whine, and the Sawyer-Mann Company fairly and squarely beat it on its own ground here in America. This company, that would like to have posed as a monopoly, has been compelled to limit its claims in the incandescent field.

It cannot make the public pay it tribute for using a natural product that was discovered before its name emerged from obscurity.

Had it succeeded in this, it might, perhaps, before it got through, have succeeded in making us pay it a royalty for the enjoyment of the light of the sun and the moon and the stars.

Under such extortion, life—to use an expression of Mr. Mantalini's—would be only one "demnition grind."

Fortunately, this was not to be, and to-day the best incandescent lights to be found in the country are furnished by the rival companies—the Brush-Swan Company, the Weston-Maxim Company and the Sawyer-Mann Company. There is still another light for which much is promised. It is the invention of Dr. Moses, and is said to be a striking improvement on the Edison light.

The advantages possessed by the "Swan" and the "Weston" and the "Sawyer-Mann" incandescent lighting systems must be easily apparent to all practical business men. Besides the excellence of the lights themselves, the system of distribution cannot but commend itself to the consumer, and we take it that the consumer has something to say.

In isolated lighting the superiority of these systems has been demonstrated an hundred times here in New York City.

Many great buildings belonging to wealthy corporations and individuals have been furnished with one of these systems that we have named, after a careful comparison had been made with the others that exist.

Projectors visiting New York should not fail to examine the "Weston," the "Swan" the "Sawyer-Mann," the "Schuyler," and the "Mather-Perkins" incandescent systems of lighting.

ELECTRICITY DIRECT FROM COAL.

The superiority of electricity as a source of light and power has come to be admitted on all hands, and, even at its high cost, it has made its way rapidly into every-day use. This is simply due to the fact that it has no disagreeable attributes, whilst its advantages are numerous; thus there is really but one objection left for its opponents to stand upon, and that is its high cost. This, for the present, places it, to a great extent, in the category of luxuries, but the time is surely coming when this last important obstacle will be overcome, and we will then have left far behind the threshold of the "Electrical Era." It is only necessary to turn to the history of the past great inventions for a basis for such a hope, and there will be found the lesson of wants supplied where great need leads the way. Take, for instance, the history of the steam-engine, and here there arose a Watt to give it practical value. Not until he perfected it by his scheme of the condensation of the steam did it really begin to fulfill its mission. That simple application of one of nature's simplest processes gave to the introduction of the steam engine the impulse whereby it has since achieved results that have made mankind wonder. So it will be with the applications of that form of energy which is destined to be its successor—electricity. To-day, throughout the world, out of every horse-power of energy used for the incandescent electric light, and indicated on the piston of the engine one-half is lost outside of the mains. According to Dr. Fleming forty-nine fiftieths ($\frac{49}{50}$) of the total energy of the coal is irrevocably lost, and but one-fiftieth is obtained in light and heat in the filament. These are indeed figures to ponder, and from them we may realize the great advantage in point of cost which would accrue from the discovery of a method to obtain electricity from coal without the intervention of the boiler, steam-engine and dynamo. More than a year ago there was first announced a determination to attack this problem and there are to-day many intelligent original workers in this direction. The first public exhibition of any recent results was that at the Inventor's Exhibition in London recently, where Mr. J. A. Kendall exhibited a battery based on the well known phenomenon of the production of an electric current by the passage of hydrogen through one platinum plate at a red heat, another being exposed to burning oxygen, these plates acting as electrodes and the circuit between the two being closed by a metallic wire. These electrodes are arranged in the form of concentric tubes closed at one end, and are separated by a fluid medium of fused glass. Hydrogen gas is continuously supplied to the inner platinum tube, while the entire apparatus is maintained at a high temperature by means of a furnace fed with coke or liquid or gaseous fuel. In the exhibit a Fletcher's gas blow-pipe was used, and a Spuegel air pump connected with the inner tube. According to Mr. Kendall the E.M.F. of this cell is 0 7 volt. Producer gas, a compound of hydrogen and carbonic oxide, may be used instead of pure hydrogen. Further experience with this battery is awaited with interest, and though should it not prove the success we hope for it, yet it will have served the purpose of stimulating effort towards the solution of this most important problem.

"HERE'S A STATE OF THINGS!"

We are informed on good authority that: "The United States Attorney for the Western District of Tennessee, Mr. H. W. McCorry, has renewed his application to the Department of Justice to test the validity of the Bell Telephone patent, and a similar application has been made by the Washington Telephone Company, of Baltimore, and both applications have been referred to the Interior Department for investigation."

Whether or no this is the beginning of another roaring comedy in three acts, or is to prove an unsuccessful melodrama, with new scenery and costumes, it is impossible at the present writing to predict.

In the last performance of this nature we witnessed, the clown was the best we ever saw, and the jokes, though not good, were at least original. But notwithstanding this, little interest was manifested until the appearance of the ballet at the end of the performance, when the house was packed and a crowd fought for entrance at the doors.

The press of the country, which seemed at first undecided, now declared that the ballet was a thoroughly artistic and successful production, and its popularity a credit to American intelligence and discernment. A portion of the press, however, who had positively refused to sanction such a performance and contented themselves in taking it in behind a wire screen, insisted that their brethren changed the position they first assumed because they had been "seen" by the management. This charge is, of course, too absurd to be considered seriously.

As we said before, we cannot say if this last action will stand or not. If private advices which we have received from Washington are true, as we believe, the position assumed by opponents of the Bell Company cannot be maintained. We have no hesitancy in making public the nature of these advices. It is said, on good authority, indeed, there are those willing to make affidavit to the facts, that Attorney-General Garland's cook is sister-in-law to the I-talian regularly stationed in the office of the Washington Telephone Company of Baltimore—though where the officers of this Company procure the means for such high-living is one of the subtle mysteries of the telephone business. But law is law, and justice is justice. The animus in the case must be immediately apparent to the meanest intellect. "'Tis not as deep as a well, nor as wide as a church door; but 'tis enough; 'twill serve." Obviously there must be constant and friendly communication between the Garland household and the complainant's office, and this, of course, would render any hostile action on the part of the government against a rival Company at once unfair and improper.

Those who have followed this matter will remember that a portion of the press first took up the matter by condemning the Attorney-General for sanctioning with his authority the bringing of a suit against a rival company to that in which he was himself personally interested. Little by little other portions of the press took up the fight, if not as champions of the Bell Company, at least in condemnation of those who would review and examine those claims, and what was only scattering fire, a desultory and feeble aggression, soon became general, and one loud and prolonged cannonade was opened upon the presumptuous officer who questioned the claims of the Bell Company.

GENERAL WESTERN NEWS.

At Steyer, Austria, a new form of incandescent lamp, known as the Puluj lamp, is manufactured, which has some peculiarities worthy of passing notice.

The material used for the filament is Manila hemp, which is given the shape of a trefoil; or better, the outline is that of a thumbless glove with but three fingers. This form is given to the material by fastening it upon a plate of iron through the surface of which are projecting pins corresponding to the curves at the ends of and between the fingers. The terminals are drawn taut, and the ends flattened at the same time by a clamp or vice. The filament is removed after having become fixed. It is then placed in a bath of mineral oil, where it is rendered incandescent and carbonized by an electric current.

It is claimed that the product is capable of withstanding a tensile strain of 24 kilogrammes per square millimeter. The flattened terminals are afterward galvanized and soldered to the platinum terminals. For joining the two metals, copper and platinum, silver solder is used.

The resistance of this lamp is 214 ohms, and it gives, with a difference of potential of 20 volts at the terminals, a luminous intensity of 20 candles, with a life of 1,000 hours.

A huge electric-light is to be erected upon the Isle of May, in the Forth, Scotland, for which the foundation is now being constructed. The luminous intensity of the light is to be about 1,000 times that of the ordinary light-house lamp, and will give four flashes each thirty seconds. The optical apparatus is of the condenser type introduced by Thomas Stevenson, Engineer of Northern Light houses. A smaller light will also be erected in place of an oil lamp which will direct its rays in another direction from the same point, A peculiarity in the arrangement of the former consists in a method of inclining the lamp downward to make its light more available at short distances in foggy weather.

Jules Godard, the celebrated aeronaut, was the inventor of a simple electrical apparatus for the benefit of balloonists, especially during night excursions. It consists of a light pallette, which, while the air-ship moves horizontally remains in its normal position. When, however, this rises or descends, the instrument is deflected, and makes contact with a battery circuit ringing a vibrating bell, thus calling attention to the change of direction.

At the recent meeting of the Electro Technical Society, of Berlin, in honor of the International Telegraphic Conference, the historical apparatus belonging to the imperial Post office department, was exhibited. The collection includes a copy of the electro-chemical machine of Sœmmering (1809), Gauss & Weber's magneto-electric telegraph (1833), Bain's needle telegraph (1847), Siemens' telegraph (1846), and many other antique specimens equally interesting.

Electricity played an important part in a recent dramatic representation, near Bradford, England, at Sir Titus Salt's Seminary for young ladies, one of whom was the writer of the spectacle called "A Midsummer Night's Fancy."

Oberon, King of the Fairies, feeling that his royal prerogatives are being encroached upon by science and its votaries, convenes his court of dignitaries, "Imagination," "Magic," "Sorcery," and "Spiritualism," and announces that inasmuch as mortals no longer obey his laws, he has decided to quit the earth and return to fairy land.

The discussion which ensues is interrupted by the entrance of "Science," who, unconverted by the false arguments of the fairy King, calls his "ministers," "Mechanics," "Physics," "Steam," and "Electricity," and a colloquy follows, which of course ends in the discomfiture of the fairy King and his retinue, and their departure for ever from their lost possessions.

Brilliant electric-lights adorn the persons of "Science," and "Electricity," and the interpretation of the spectacle, which was done entirely by young ladies, was perfectly successful.

The withdrawal of that Memphis suit, where Uncle Sam was expected to grind to impalpable powder the great monopoly, reminds one of the old rhyme, the original of which read:

"The Duke of York, with forty thousand men,
Marched up the hill—and then marched down again."

The question naturally arises, what was the object of the grand charge? Was it that of a huge army of stock bears, or was it an honest attempt, based on conviction, to set a wrong right, to throw the telephone into the public domain, and thus annul the bottom rights of all telephone inventors. Surely, if this were done, in the race for supremacy he who was first established must have stood first in the contest. The present so-called monopoly is not alone dependent upon the assumed inventions of Reis There are in the hands of the so-called monopoly many—very many improvements, equally as vital to successful telephonic work as the magneto telephone, which, in addition to the thousands of plants occupying the territory today, would certainly give a decided advantage to the existing system, and experience has, through several years of practical work, added constantly to a long list of such improvements, which are the property of the Bell company. If honest competition were the object sought, with new apparatus, new methods, and fair rates for service, the road to success would be a rugged one indeed, and a very large outlay of money would be required to make a start; while if ruinous opposition were the policy adopted, no new recruits would be nearly so well prepared and disciplined for the fight as the regulars now in the field. What the real object of the move was, or whether it was all a mistake, an error, a misunderstanding is one of those things no fellow can find out.

In the meeting of our council, on the 12th instant, considerable discussion was indulged in on account of the introduction, by Alderman Manierre, of the following order of inquiry relative to the ways and doings of the Chicago Sectional Underground Conduit Company:

Whereas, On July 31, 1882, page 97, Council Proceedings, an ordinance was passed granting to Henry Corwith and others, their successors or assigns, the privilege of constructing and operating an underground conduit for electric wires in the streets and alleys in the city, which said franchise is now held by a corporation known as the Chicago Sectional Underground Conduit Company, that section 5 of said ordinance provides that other persons shall be allowed to use said conduits, after being duly authorized by ordinance; and

Whereas, It is reported that said conduit company has allowed parties to use said conduit without such parties having first obtained the consent of this council by a proper ordinance, while it has excluded others who are desirous of securing its benefits and willing to pay for the same; that said conduit company has granted to persons the right to dig up the streets for the purpose of laying electric wires on permits to said company for its own use by the Department of Public Works, all of which are in direct violation of the spirit and letter of said ordinance; and

Whereas, Said conduit company has failed to appreciate the fact that a most valuable franchise was granted to it by the city, in that it compelled the city to pay a bonus of $10,000 for the privilege of providing for its wires; it is therefore

Ordered, That the Law Department be and is hereby directed to cause an inquiry to be made as to the above facts bearing upon the violations of said ordinance, and to take such action toward the forfeiture of said franchise as the value of the evidence will warrant, with the view of obtaining for the city the privilege of using said conduits without cost, and to secure the money paid to them by the city for such privilege, and report to this council what action it has taken in the premises.

The alderman said his resolution simply called for information, and he moved to suspend the rules to pass it, which was carried, and the order was subsequently adopted.

An ordinance was offered, permitting the Schuyler Electric Light Company to lay wires along and across streets and alleys in the district bounded by Madison and Monroe, Dearborn and Wabash avenue, which, after a similar skirmish to that above, went to the Committee on Fire and Water.

The city electrician was directed to prepare estimates for lighting the river, and the north and south branches from Kenzie to Harrison street.

The Milwaukee Council, on the same evening, held a rather turbulent session on wires and lights.

Two weeks previously, at the regular meeting of the council, a valuable franchise was granted the Badger Electric Light Company, permitting overhead as well as underground wires to be run—each within prescribed districts.

In the issue of the REVIEW of last week it was stated that Mayor Wallber would veto the ordinance as passed by the council. His action, according to his veto message, is based mainly on the running of wires above-ground. The veto was sustained by a similar vote to that by which the ordinance was adopted—25 to 14.

Subsequently, Alderman Lynde introduced a second ordinance, amended from the vetoed proposition, increasing the list of streets required to be laid with underground wires, and removing some technical features which the Mayor objected to; and still another ordinance in favor of the Sperry Company was introduced by Alderman Dunck, which was characterized by the president of the council as "a fraud from commencement to end, and is only brought in by the gas monopoly to defeat the Badger ordinance." The two companies — the Badger and the Sperry—are Chicago organizations.

Cincinnati's Board of Police Commissioners, in accordance with a report from the superintendent of the patrol service designating localities for forty additional patrol boxes, scattered through six districts of the city, will authorize their installation at once; and it was made the sense of the board that it would be advisable to request suggestions from the public as to where other boxes should be placed. The system used at Cincinnati is the same as in vogue in Chicago—that of the Police Telephone and Signal Company.

Col. Lynch, 144 La Salle, gives the following quotations of telephone stock values at date:

Chicago	$375 @	$400
Central Union	50 @	53
Michigan	63 @	66
Iowa Union	18 @	20
Great Southern	30 @	35
Colorado	10 @	12
R. M. B.	40 @	45
M. & K.	54 @	57
United	14 @	15
Cumberland	70 @	75
Pennsylvania	48 @	52
N. Y. & N. J.	61 @	63

CHICAGO, Oct. 21, 1885.

— The Swan Safety-Lamp for miners consists of the lamp proper and a secondary cell-battery. The weight of lamp and battery together is 6¾ pounds, the cylindrical case containing the cells measuring 8 by 4 inches. The light given, for twelve hours' use, is equal to half a standard candle; but by reducing the time of lighting to eight hours, the current may be increased, and a light obtained equivalent to three-fourths of a standard candle. A single charge provides for a whole day. Mr. Swan holds that the electric lamp is absolutely safe. If it is neither so light or so cheap as the ordinary lamp, it is in both respects at least practicable, and the working cost will probably not be more than that of the ordinary lamps. As regards weight, he is not without hope of being able to reduce it. It requires no air; and there are, unfortunately, times after an explosion of fire-damp when the air of a pit is so foul that no oil-lamp will burn in it. When a Fleuss apparatus for breathing and the electric safety-lamp, the work of exploration, which can hardly be otherwise accomplished, may be carried on, and this, it is reasonable to hope, will be attended with the saving of life.

— Johnstown, Pa., expects to have her system of electric lighting in operation within the next three months.

— The Pennsylvania girl who married a messenger boy was evidently determined to choose a young man who could not be accused of being fast.

— "I cawnt understand, you know, why these fellows don't stop their infringing. We ought to have the entire incandescent field without all this blasted opposition, don't you know."

—A deposit of sal-ammoniac has been discovered at Churchill, Col. It covers several acres. Sal-ammoniac is a valuable article of commerce, and was first discovered in the sands of Africa. It is worth in its crude state about $400 per ton.

— The Reading (Pa.) electric-light company has purchased from A. J. Hain the property now occupied by him as a coal yard, on South Seventh street, between Franklin and Chestnut. The lot extends from Seventh back to Lemon street, 230 feet, has a frontage on Seventh street of 70 feet, and on Lemon of 150 feet. As soon as the company obtains possession it will begin fitting it up for its business and will remove its plant from the present location. The company will greatly enlarge its equipment and facilities, and by next spring will be ready to furnish the incandescent light.

— A little of the history of electric lighting in the city of Topeka, Kansas, is given in the following from the Topeka *Commonwealth*. This enterprising western city should have its wide avenues and streets lighted by electricity, for if it can afford gas it can afford the electric light: "A few years ago the city made a contract with the electric-light company to light the city by the tower system. It was a better contract than the city every made or ever can make again. The Electric Light Company composed almost entirely of citizens of Topeka, on the faith of the contract went to an expense of $20,000 to carry out their part of the contract. The city itself went to a large expense to build the towers. How that contract was set aside by the city and how much the city paid to get out of the contract that related to the towers is well known. Afterwards the city, by resolution, directed that the lights should be put on the bridge and at certain street crossings. The lighting company expended $500 to carry out the requests of the resolution, but before the lights were put in, the city again repudiated its part of the bargain. Now, that there is absolute necessity for more lights on the streets, the city, by approving the report of its committee, propose to go to more expense for gas lamps, and keep up the old system of lighting that is being discarded in most cities, and is more expensive than lighting by electricity, when the amount of light is taken into consideration. The city council, if it has got any sense of obligation, or of what is its duty, should remember that the Electric Light Company still has a valid claim for heavy damages against it on account of the non-fulfillment of its former contract. This claim has been held in abeyance because of the plea of poverty on the part of the city, and its promise, when anything was done towards additional lighting, that justice should be done. Topeka is unfortunate in having a council that lacks intelligence enough to conduct its business on honest principles, or are willing to be just."

National Telephone Association Proceedings.

Editors of the Electrical Review:

Dear Sirs: I have several orders for copies of the proceedings of the first and third meetings of this Association, which I am unable to fill, none being in possession of this office. Possibly some of your numerous readers may have spare copies, which they would be willing to exchange for those of the fourth, fifth and sixth meetings; if so, you will confer a favor by addressing,

Yours very truly,
C. H. BARNEY, Secretary.

New York, Oct. 18th, 1885.

Telephonic News

*** There was a rise in Bell telephone to 182 last week, the action of President Cleveland in the Garland-Pan-Electric matter helping the price.

*** The application of the Pan Electric Telephone Company is reported by Attorney Bradley Johnson to soon be referred to Secretary Lamar, who will pass upon it, and decide whether the suit against the American Bell shall be prosecuted or not. The likelihood is that it will not be heard of again.

*** An exchange claims that "Hello" has been abandoned as a telephone starter, and the expression "A there!"—a curruption of "Ah there!"—is the proper thing, as it rhymes with the answer of the young lady at the exchange, who sings back, "Stay there!" And quite often he has to "stay."

*** There is still considerable interest taken in the rise of telephone rates throughout the territory of the N. E. Telephone Company. Some telephones have been ordered out, and others are awaiting developments.

*** The unkindest cut of all that Attorney-General Garland has received, came from a friendly source. The New York *Sun* says that, unlike many other holders of telephone stock, Mr. Garland, should he decide to sell his Pan-Electric stock, it would be "impossible to sell at a loss."

*** The population of Buenos Ayres, capital of the Argentine Republic, is 300,000. The United Telephone Company of the River Plate, have now connected up a little over 3,000 subscribers. The company's receipts for July last, were over $11,000. We think for a town in South America this is a pretty good showing, and much of the credit of this excellent exhibit is due to F. W. Jones, the general manager.

*** Mr. R. B. Boyd, one of the best men connected with the American Bell Telephone Company, has been appointed to take charge of the Eastern Division, in place of A. O. Morgan. Mr. Boyd is a deserving and popular gentleman, whose work in the telephone field has always been intelligent and progressive, and the Bell Company has done a most sensible thing in enlarging his responsibilities.

*** The telephone business in the Pacific Ocean is very good. At Honolulu the Hawaiian Bell Telephone Company has a list of more than four hundred subscribers, and other companies on the various islands of the kingdom comprise some six hundred more. Mr. Jno. Cassidy, well-known to many of our readers, is the general superintendent of the Hawaiian Company, Mr. Godfrey Brown, president, and Mr. J. F. Brown, secretary.

*** Messrs. Holmes, Booth & Hayden have lately commenced the manufacture of lead-covered wire in addition to their other electrical goods. Their lead-covered wire is made by a new process, which makes it quite pliable and, they state, cheaper in cost than any on the market. For permanent installations and places subject to dampness this is certainly a most desirable article,

*** The patent for the "Law" telephone exchange system, for which the application has been pending since 1880, has a history, evidently somewhat similar to that of the patent in the Sawyer-Man incandescent-lamp case. Our readers will remember that the patent on the carbon filament for incandescent lamps was granted to Sawyer and Man (now owned by the Consolidated Company), after a five-years controversy in the Patent Office, and that it should come as it did, and at the time it did, was a flood-rock explosion to the opposing electric-light company, which had just commenced with a flourish of trumpets and numerous carefully-prepared interviews—written, no doubt, by the aid of their own incandescent lamps—a series of suits against all other electric-light companies inviting them to step up and render homage and tribute to the "own and only." At the present writing, this invitation had not been accepted. The kindly aid of the Patent Office provides us with news and surprises, keep the attorneys employed, and prevents lethargy from seizing upon any branch of the electrical field. Perhaps the Law patent was expected; anyhow the Western Electric Company have it, and if their rights under it have been infringed they will no doubt be heard from.

*** The New York *Daily Telegraph*, of Oct. 16th, contains the following, evidently from the pen of the electrical reporter: "For many years electricians have been studying a way to kill *conduction* on telegraph and telephone lines. It is said that Prof. Gillette of this city has solved the problem. Several days ago a test was made on Long Island in the presence of officers of the Long Distance Telphone Company, which was highly satisfactory. It is understood that with the use of this instrument any telegraph line can be used for telephone purposes, a thing which has heretofore been deemed impossible." We should like to see Prof. Gillette's "Conduction Killer" at work. It must have phenomenal powers.

*** In the *Gazette*, of Honolulu, September 30, there appears a decision of the Supreme Court of the Hawaiian Islands that contains some sensible conclusions. The case is one where the Hawaiian Bell Telephone Company brought suit against the Mutual Telephone Company. The plaintiff alleging that the defendant during twelve months past had erected poles and wires in Honolulu for the purpose of its business, but so negligently, carelessly and unskillfully that they have come in contact with the plaintiff's wires, and had interrupted the circuits of plaintiff's wires and had destroyed their insulation, and had interfered with plaintiff's wires, etc. The judges decided in favor of the Hawaiian Bell Company, stating that "the advantage which the first occupier of the street sides for purpose of erecting poles is certainly considerable. It has the choice of position, and what has been granted to it and what it has taken and occupies under its franchise cannot legally be granted to a subsequent company. A subsequently-formed corporation takes its charter with this knowledge, and must erect its lines with reference to the occupancy of the company holding the previous franchise, and takes the space that is left unoccupied. If this were not the law, a third or fourth corporation might claim that it could run its lines intersecting or interlacing those of all previous companies, and thus practically destroy their franchises. For a new company to suspend wires over a former established system of wires, so that by the expansion, caused by heat, they would sag, and thus come in contact with the lower wires and remain so, would be trespass upon he rights of the former company."

New York Electrical Subway Commission.

(*Continued from third page.*)

factory at the rate of 1,000 to 1,200 feet a day. They are loaded on the cars as fast as made and shipped to Detroit where I am laying about a mile a week. There are no leaks. I take some of this liquid asphaltum and use it for making the joints. Professor Gray said he did not want the ducts made perfectly continuous; he would sooner have the dry air there."

A Gentleman—"How many wires do you carry through a section of that kind?"

Mr. Dorsett—"It depends on the insulation a good deal."

Mr. Shelbourne—"Is that the patent of August 2d, 1881?"

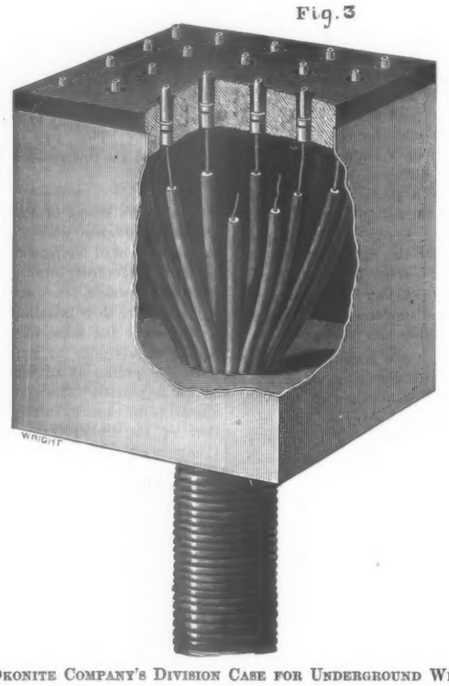
Mr. Dorsett—"The patent of August 2d, 1881, is the patent on my original material. There is a subsequent patent."

Mr. R. W. Pope—"These pipes are put down in this plan alongside of each other. I wanted to ask if they could be put one above the other?"

Mr. Dorsett—"It depends on the pipes in the streets."

A Gentleman—"Can you give an estimate of what the cost would be of laying it in New York?"

Fig. 3



The Okonite Company's Division Case for Underground Wires.

Mr. Dorsett—"I have not made any estimate in regard to that."

Mr. Smith, representing the Okonite Company, was next heard.

Mr. Smith—"I appeared before you previously to explain to you a plan of mine by means of which those wires are put underground. We have to-day the connection-box of full size, as it would be on the streets. At the same time, I have thought out a plan under which I propose to lay the wires. All those squares (referring to plan) represent blocks. This location here would represent a central office. These are the longitudinal avenues of the city of New York, those are the cross streets. I contemplate laying the cables in the cross streets. The cables run down into the main avenue, where the cables would terminate in a central office. At every block I would have one of my connection-boxes. This red line running through the street is the cable. In connection with this cable, I would lay a duct right round the block, and have another one of my connecting boxes in connection with this duct, by means of which I can lay single wires to every house which is in the block all around. They come either around this way or this way (indicating), connecting here in this small connection-box that leads into the main connecting-box of the cable, and from there it runs into a central office. By this means I can reach every house in the block. Electric-light wires I propose to lay on the other side of the street, and use the same duct for the distribution of the wires into houses or buildings. Telegraph wires, if they do not go in the same cable with the telephone wires, can go in a separate cable. As I have stated before, my system consists of a cable, which is in itself protected, and this is laid direct in the ground. In the first place, when we start, the insulation will be such that we can lay it without regard to moisture, because the foul air and the gases, and so on, are more injurious to the insulation than water. If the insulation is of such a structure that it is not waterproof, it is good for nothing at the outset. The cables that run across the Atlantic are waterproof under a tremendous pressure of water, while they would not last under the influence of gases in conduits. This cable is easily transportable, and occasions very little trouble in tearing up the streets, and furthermore saves a great deal of inconvenience. The connection-boxes, one of which I have here, facilitate the testing of any line or lines from the central office, because no splices are to be laid. The connections are absolutely waterproof; they are self-sealing and self-connecting."

Mr. Cheever, President of the Okonite Company—"I simply wanted to say, in addition to what Mr. Smith has said, a word in regard to the question of economy in laying our system and the question of not obstructing the streets any more than is necessary, in case additional wires have to be laid or changes have to be made, the laying of our cable for a given number of wires is immensely cheaper than a conduit. It can be laid within a few inches of the surface. It is small; it does not take much space. In case more wires are to be laid (of course, in the first place, you provide for the reasonable wants for a reasonable period), as more cables were needed from time to time, as the telegraphic or electric business grew, it would simply be a question of taking up one row or two rows of paving stones a few feet at a time. This cable is sufficiently flexible to be put on a reel. It can be rolled along in front of the opening. In case of disturbance by reason of repairs to sewer pipes or water pipes, there is no liability of damaging the conductors. That cable we have here is a 50-wire cable for telephone purposes. It would be a little larger for telegraph purposes. If there was a breakage of a sewer pipe in a house which necessitates the opening of the street, I suppose ten or fifteen feet could be opened, leaving the cable suspended, and it would stand there of its own weight without any question of damage. The peculiar feature of the armor—aside from the question of insulation, which I will not say anything about, although, of course, we consider it the best—is, first, the inside armoring for tensile strength which will hold it across the space. Outside of that we put on a protective armoring spirally around it, which protects it against any abrasion from pickaxes or shovels, or another disturbances of that sort."

Mr. Smith—"I would like to submit a sample of the cable. This (showing) was struck a very sharp blow with a pickaxe. If a man should happen to strike that with a pickaxe, he could not injure it or injure the conductors. Furthermore, it is proposed that they should be coated with asphaltum before going into the ground."

Mr. Cheever—"There is just one more remark I would like to make—that is as to the question of cost. In estimating the question of cost of conduits, they estimate that they would cost so much a foot, but do not include the cost of wire. Now, our estimates necessarily embrace the wire, and, in starting the question how much the conduit is going to cost, the bare pipe is one question, and another question is so much a-foot for the wire. Our covering is comparatively very cheap."

This style of armored cable is brought in use with the following described connection box and division cases, forming together a new system to lay electric conductors underground without conduits:

Fig. 1 represents a perspective of such a connection base before it is set underground. This illustration shows also five cables,

which meet in the connection case and terminate in five division cases.

Fig. 2 is a vertical cross-section of the same base.

No. 3 is a perspective view of a division case, part of the case being open to show the interior division of the cable and the manner of fastening the separate conductors to the metallic studs in the top plate. The connection base, Fig. 1, is made of cast iron, and consists of three different parts—the base *A*, the upper section *B*, with a square rim, and round cover *C*.

In the upper section *B* are five division cases *D*, arranged in the shape of a cross. The five cables, meeting in the connecting base, terminate in those five division cases, as shown in Fig. 3.

The division cases consist of a bottom plate, a square case and a top plate, which is made of hard rubber, and provided with a number of systematically-arranged metallic studs.

Those studs are provided with a screw thread at the lower end, and are smooth and tapering at the upper. A small hole goes through the center of the stud to receive the bare ends of the conductors. The studs are screwed in the rubber plate, and the smooth taper end is surrounded by a recess made in the upper surface of the rubber plate.

The manner in which the cable is fastened, divided and insulated in the division cases is thus: The cable end is passed through a hole and screw sleeve in the center of the bottom plate, and about ten inches of cable are relieved of the armor. The cable is opened to separate the conductors. A few inches of the conducters are stripped of the insulation covering them, the bare conductor ends are drawn through the holes in the studs of the top plate and soldered to the studs—one conductor to each stud. Then the case is fastened to the top and bottom plate, and the hollow space of the case is filled with melted okonite or asphaltum. This divides the several conductors, and insulates them to the tip of the studs.

To each end of a cable section such a division case is attached, and the laying of the cable may begin.

The base *A* of the connection box has four pockets or recesses *L*, as may be seen in Figs. 1 and 2.

The base *A* is set underground at the street crossing—the pockets *L* in the direction of the streets.

A narrow trench of about eighteen inches deep is made near the curbstone from the connection base, set in on one street crossing to the street, where another connection base is to be set.

The armored cable is laid in the trench, with the division cases resting on the proper place of the base *A*. The cable is bent to lay in the pocket of the base, so that the division case stands vertical. In the same manner the other three cables are laid in the respective directions. After this the pockets of the base *A* are filled with melted asphaltum.

The five, or central division case and cable, are set also. The fifth cable passes through a pipe *M* in the center of the base. The one end of the fifth cable terminates in the basement of the next corner building, from where it can be continued and carried through the whole block of buildings. This fifth cable serves the purpose to make connections with every building and the trunk lines.

After the fifth division case is also arranged on the base, as stated, then the upper section of the connection base is set on the base and fastened thereto. Then melted asphaltum is poured in the upper part about one inch deep, so that it partly surrounds the lower part of the division cases. This excludes all possible chances of water to get in the connection base from underneath. The cover *C*, which is level with the street surface, is screwed down with bolts, and a packet gasket excludes water from above.

The connections of one conductor with another is made by means of a flexible insulated cord, provided at each end with an insulated metallic connection tip, which is pressed on the taper part of the studs protruding out of the recesses in the top plate of the division cases.

Vice-President R. S. Waring of the Standard Cable Company then briefly presented the exhibit of that company, and called upon Mr. G. L. Wiley to continue the subject.

Mr. Wiley said:

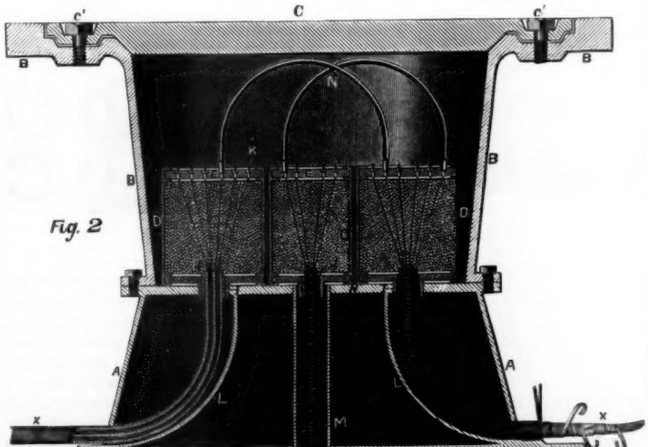
Mr. President and Gentlemen:

"I have the honor to present a statement and drawings of the underground cable system of the Standard Underground Cable Company for telegraph, telephone and electric-light uses.

Fig. 1.

OKONITE COMPANY'S CONNECTION BASE FOR UNDERGROUND WIRES.

Fig. 2



VERTICAL CROSS-SECTION OF SAME.

"The insulating material used by this company is a hydro-carbon compound of very low specific inductive capacity and the highest attainable insulating qualities, in fact, very much in excess of that practically required in the working of any telephonic, telegraphic or other electrical system. From actual measurements made by Mr. Frank L. Pope for the New York Fire Department on cables of our lightest insulation, the insulation resistance was found to be 946 megohms per mile. The insulating compound employed being an inorganic substance, there is thus no reason to anticipate any deteriora-

(*Continued on eighth page.*)

.... The subject of enhancing the efficiency of the Police Department by adopting a system of telephone and telegraph signals has taken definite form at Hartford. In the council, a communication from the police commissioners asked for favorable action, and represented that the expense would not exceed $4,000. The communicawas referred to a joint special committee by the upper board, and to the committee on ways and means by the lower board. The project can make no progress, under this disagreeing act on, until the next meeting fo the common council, but something seems to have been gained by the formal request of the police commissioners for the much-needed auxiliary. Hartford is a long distance in the rear in this matter of modern police facilities, a fact which is, of course, more readily appreciated by the department officials than by the public generally. The expense would not raise so great a question if the demands of the service and the merits of the auxiliary were fairly understood. The signal system would be to the Police Department what the fire alarm is to the Fire Department. The greatest alacrity is essential to the preservation of property, and it is certainly as important to have prompt service in the protection of life and suppression of crime. There is daily and almost hourly use for a police telegraph system, at the present time.

TELEGRAPHIC

.... In the case of the executors of F. O. J. Smith, asking the Western Union to account to them for large sums of money, the United States court at Portland, Me., has granted complainants leave to file their bill of revivor. This suit commenced in June, 1875, and this decision is in favor of the executors.

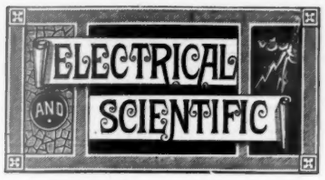
.... In speaking of the growth of the Baltimore and Ohio Telegraph service, Mr. Garrett said that the executive officers of the company are engaged in the preparation of certain plans for the extension of its lines into valuable Northwestern territory and toward the Pacific coast. He believes that the Government will at no distant day enforce those provisions of the land grant under which railroads and telegraph lines were built, which require that the business of all competing telegraph companies shall be transmitted over those lines impartially and upon equal terms, thus enabling his company to materially increase the area over which it is a competitor to the Western Union system.

.... The Financial Telegram Company, which controls for New England the new system of printing telegraph instruments of the Commercial Telegram Company, of New York, is putting its tickers into a large number of banking offices on Congress, Devonshire and State streets, Boston. They go in on trial and without cost for a month, if not retained. If retained, the price will be $10 per month. The gold and stock tickers cost $1 per day. Greater speed and more extensive quotations are claimed for the new instrument, and it appears to be making a good record thus far.

.... The case of the Western Union Telegraph Company *vs.* McGuire, decided by the Supreme Court of Indiana, arose out of an action to recover a statutory penalty for refusing to transmit a message. The defendant company set up that the plaintiff was a transient person or stranger, that his message required an answer, and that a by-law of the company, which plaintiff refused to comply with, required pre-payment or deposit in such a case. The court held that it was fairly inferable that the sender of a message was to pay for the answer, that the telegraph company had a right to proceed on this natural inference and take reasonable measures to obtain compensation for its services, and that a rule requiring a transient person to deposit the amount legally chargeable for an ordinary message was reasonable.

.... Superintendent Gill, of the Western Union at Philadelphia, in speaking about underground wires, says: "I don't know how long this matter will be before the councils, but we are going to make all arrangements to commence work as soon as we get permission. The work will be pushed rapidly, and we hope to be able to get our wires down in two months. These wires will include all the wires running out of the city to the South and West, and as many of the local and other wires as we find practicable. This is only an experiment, and if it is successful, within five years every one of our lines in this city will be underground. The office in the old church will be the terminus for all the wires in the present main office, and for as many of those in the central portion of the city as practicable."

.... Florence, the actor, tells the following concerning Morse: "I can remember," he said, "years and years ago, going to a dinner down in Fourteenth street, given to Morse, the telegraph inventor. He was an elegant old gentleman, but when he got on his legs to talk he was awful long-winded. I had a friend with me. We listened to Morse's speech, while he predicted great things for electricity. I remember he predicted, too, that some day men would be able to talk over the wires for distances of fifty miles, and that every ship that left harbor for an ocean voyage would be connected with the land by wires. When he got that far, my friend said, 'What rot,' and we went out. I have often remembered how foolish his talk sounded to me. Yet it has been all realized, except as regards ships at sea. I believe even that will come about some day."



* * Curt W. Meyer, of this city, the inventor of the "Curt" battery, has just received letters patent for his "Electric Laryngoscope," for which the application has been pending nearly a year. Mr. Meyer's laryngoscope is a valuable one, and was fully described and illustrated in a recent issue of the REVIEW.

* * Wm. M. Block, of Shamokin, Pa., has invented an electric fire-alarm system that has been adopted by his town. The system is an inexpensive one, and can easily be afforded by those towns where the expense of a complete alarm system has prevented the citizens from putting in any. This alarm signals by means of whistles, the number of toots indicating location of fire.

* * Before the close of another week it is expected that the new Field motor will be seen on the track ready for experimenting. Among the problems that will first receive attention will be the regulation of speed and the tabulating of electric traction power. The steam whistle, which is now used occasionally at night and in foggy weather, is missing from the motor. Its place will probably be supplied by powerful electric bells. Then the question of adopting one of the various systems of heating and lighting the cars that have been invented will be considered, and the invisible element will be called into requisition to perform these services.

* * While a number of telegraph linemen were stringing wires Sunday between Derby and New Haven, they were caught in a heavy thunderstorm. Lightning struck a wire, and followed it along to a post on which were three men. All of them received a severe shock. The man highest up from the ground threw up both hands, and fell upon the man below him unconscious. He was lowered to the ground. On his breast was found three parallel marks. After some time he recovered consciousness. Farmer Henry Taylor was at work in a field near by. His long boots were taken off his legs, and he was badly burned by the lightning. A pile of potatoes was scattered all over the field.

* * Mr. Andre, mining engineer, in the *Colliery Guardian*, says: "Electric tramways are now in active work at the collieries of La Peronniere, near Rive-de-Gier; Thibault, near Saint Etienne; and Saint-Claude, near Blanzy, in France. In every case, the results are said to be satisfactory. Several of these tramways have been laid down at collieries in Germany, and one will soon be completed for similar work in Belgium. An improved electro-motor for such lines, which I examined the other day, give an efficiency of 94 per cent. As a good generator gives about the same efficiency, the loss of power in transmission from the engine is only about 12 per cent.

* * M. Kergovats, a chemist of Brest, has proposed a new method of disposing of the human body after death, which he considers preferable in every way to either burial or cremation. His system is an antiseptic one, much simpler and less expensive than the old process of embalming, and is nothing more than a new galvanoplastic application. The body is coated with a conducting substance, such as plumbago, or is bathed with a solution of nitrate of silver, the after-decomposition of which, under the influence of sunlight, leaves a finely divided deposit of metallic silver. It is then placed in a bath of copper sulphate, and connected for electrolysis with several cells of a gravity or other battery of constant current. The result is that the body is incased in a skin of copper, which prevents further change or chemical action. If desired, this may be again plated with gold or silver, according to the taste or wealth of the friends of the dead. M. Kergovatz has employed the process eleven times on human subjects, and on many animals, and states that in all cases it was perfectly satisfactory.

New York Electrical Subway Commission.

(*Continued from seventh page*)

tion from time and use, and this has been abundantly proven by the results in the cables of this manufacture longest in use. Even so good an insulator as gutta-percha cannot be handled without danger at a higher temperature than 100 degrees Fahrenheit, while at a temperature of 112 to 126 degrees paraffine melts. Now, the heat in the steam-heating pipes must be above the boiling point of water (212 degrees), and a temperature much lower than 212 degrees will vaporize paraffine and destroy the usefulness of gutta-percha and most other insulating materials. The vaporizing or carbonizing point of our insulating compound is extremely high, so that cables, the conductors of which have been treated with this compound, can with entire safety be laid in close proximity to steam-heating pipes (a rare and important advantage), especially in New York city where so many steam-heating pipes are already in use in the principal thoroughfares, and where at any time additional pipes are liable to be laid alongside of existing underground cables.

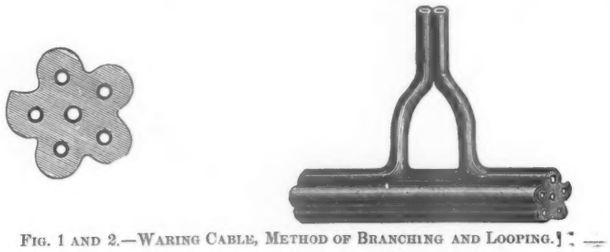


FIG. 1 AND 2.—WARING CABLE, METHOD OF BRANCHING AND LOOPING.

FIG. 3 AND 4.—WARING FLAT AND BUNCHED CABLES.

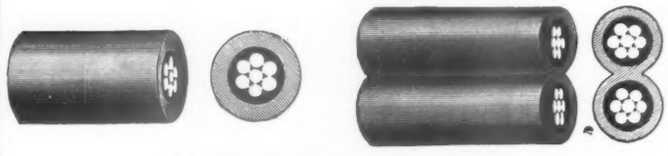


FIG 5 AND 6.—WARING ELECTRIC LIGHT CABLES.

"*The Waring Anti-Induction Cables.*—These are manufactured in many forms to suit a variety of uses, and may contain any required number of conductors, but whatever the form, the general principle of construction is substantially the same in all. The conductor is first enveloped in a wrapping of fibrous or textile material, which is then saturated and coated with our insulating compound, to which the name 'ozite' has been given, and the whole is afterwards enclosed in a continuous sheathing of lead, which is pressed closely around the insulated conductors, each conductor being separately surrounded by the metal on all sides. This metallic sheath serves to perfectly screen each conductor from all induced currents from adjacent parallel conductors, making it the only absolutely anti-induction cable, and the only cable in which telegraph, telephone and electric-light circuits may be worked side by side without interfering the one with the other. The disastrous effect of induction on telephone circuits is so well known that no elaboration is needed. In the Waring Anti-Induction cable the inductive action from wire to wire is, of course, effectually cut off by the intervening shield of metal, a feature which renders the cable peculiarly well adapted for the telephone service. But not only does the construction of this cable prevent interference from induction in the cable conductors themselves, but also where air lines are connected to even a short length of the cable, the latter is found to eliminate induction.

"No underground cable that does not embody this anti-induction feature is adapted for a general underground system in which telegraph, telephone and other electric circuits may be worked in the same cable.

"*Branching and Looping.*—In any general underground system facility of branching and looping is an important requisite, and this is a special feature in the Waring Anti-Induction Cable. It will be observed that one of the exterior ridges of the cable shown in figure 1 is somewhat different in section from the others, being provided with a sharp edge or corner which serves to designate the position of one particular conductor throughout the entire length of the cable. The position of one conductor being known enables the position of any one of the others to be readily determined; the principal object of this arrangement is to enable a branch or loop to be inserted into any one of the conductors of the main cable without disturbing the others. The way in which this loop is inserted into the cable will be understood by referring to figure 2; the branch or loop itself is usually a two-wire cable divided at the end for a short distance as shown, and its conductors so read apart and attached to the several ends of one of the conductors of the main cable which has been previously opened for the purpose, after which the lead coating is made continuous by a soldered joint similar to that employed in fitting up water pipes.

"The cables are made in continuous lengths in the factory, and are divided into suitable lengths for convenient handling in transportation and laying, and the ends of the lengths are united when laid by a simple and efficient joint or splice.

"*Compactness and Flexibility.*—For trunk lines and general street service 2,000 to 8,000 of these anti-induction cable wires (according to the style of cable used), may be laid in a box one foot square. Any of the forms of cable shown above are especially adapted for this purpose as they are flexible, are easily and quickly handled, and will pack in a small compass, and their flexibility prevents all injury from the settling of the earth from the effects of frost or from other causes. By using the style of cable shown in figure 3 (an eleven-wire double flat cable) fully 8,000 conductors can be placed in a box or conduit one foot square.

"*The Waring Bunched Cable.*—The Waring Bunched Cables (figure 4) are made for telephone and telegraph uses, and any desired number of conductors up to one hundred may be bunched together and covered with a single metallic sheath or lead pipe. In these cables the same high insulation is attained, but the facility of branching and looping, and the entire freedom from induction are not attained in such perfection as in the Waring anti-induction cables just described.

"*Electric Light Cables.*—The Standard Underground Cable Company manufacture cables of different styles and containing various sizes of conductors and thickness of insulation, both for arc and incandescent electric-lighting. Figures 5 and 6 show samples containing conductors composed of strands of smaller wires; their high insulation and non-liability to injury from heating, render them peculiarly well adapted for carrying the heavy currents required in arc lighting.

"*Conduit.*—Many conduits have been invented through which it is necessary to draw the electric cables after the conduits have been laid and closed, but the majority of them seem too expensive for practical use, and there is always danger of injuring the cables in drawing them into the closed conduit. A very inexpensive and serviceable conduit can be made of hard yellow pine, with a lifting cover to give easy access to the interior. A conduit of this nature, measuring one foot square inside, would hold from 2,000 to 14,000 conductors. It may be objected that the cables should be easily accessible without again tearing up the streets for branching, looping or increasing the plant. In order to provide for such contingencies a sufficient number of manholes can be established to answer all purposes of branching and looping, and the low first cost of this simple conduit will permit a saving sufficient to enable the various companies when laying the conduit or box to anticipate and provide in advance a sufficient number of conductors for their future need.

"The underground cables of this company are in successful use by the Municipal Telegraph and Telephone Department and by the National Government departments in Washington city, the Baltimore and Ohio Telegraph Company, the New York Fire Department, the Municipal Telegraph Department of Philadelphia, the telephone companies of Pittsburgh and Chicago, the United Lines Telegraph Company, and by the Union Switch and Signal Company and others on railroads, in many mines throughout the country, etc., etc.

"To summarize, we claim for the underground cables hereby presented:

"1st. Extremely high insulation, and very low specific inductive and electro-static capacity.

"2d. Freedom from induction.

"3d. Elimination of induction on through circuits composed partly of air-lines and partly of cables.

"4th. Greatest facility of branching and looping.

"5th. Ease and rapidity of laying underground.

"6th. Compactness and flexibility.

"7th. Durability and freedom from interruption when once laid.

"8th. The mechanical protection afforded by the lead covering.

"9th. Perfection of the mechanical work.

"10th. They have stood the test of time.

"Among others who are to-day practically using our cables are the Union Switch and Signal Company of Pittsburgh, and the New York Fire Department. I understood Mr. Frank L. Pope, now present, is connected with the former company, and I would respectfully suggest that the Commission call upon Mr. Pope for a statement of his knowledge in the premises, and upon Superintendent Smith, of the New York Fire Alarm Service, also present, for a report of his experience with the Waring cable."

Mr. Pope, on being appealed to by the Commission, stated that he is a Director of the Union Switch and Signal Company, who have placed nineteen-twentieths of all the electrical railway signals and switching apparatus now in use in this country. After explaining the system used by the company, and the necessity therein for reliable wire service, Mr. Pope stated that they had experienced great trouble with all the different kinds of wire used until they began to use the lead-covered wire of the Standard Company, which had proved entirely satisfactory. Mr. Pope also informed the Commission that he had made careful tests of the Waring Cable for the New York Fire Department, which tests had shown a degree of perfection far beyond his expectation. The insulation of this cable, he stated, is of an inorganic nature, not liable to change, and in his opinion this is an essential feature of any successful underground system.

Mr. J. Elliott Smith, Superintendent of the New York Fire Alarm Service, informed the Committee that his department had used several sections of the Waring cable, varying in length from one hundred to eight hundred feet, for the past eighteen months, and the results have been uniformly satisfactory. The confidence of the Fire Commission, in the reliability of this cable, is proven, he said, by the fact that they are about to place all their circuits, one hundred and seventy in number, underground by this cable, from headquarters outward for several blocks in each direction.

Following Mr. Smith, Mr. W. J. M'Elroy, Electrician of the Standard Company, addressed the Commission stating that the first piece of cable made by Mr. Waring was laid between the Vesta and Brilliant Oil Refineries on the Allegheny River in the early spring of 1882; this cable contained five wires and was a little more than half a mile long. In the fall of 1882 this cable was continued on down to Pittsburgh, terminating at a point on Duquesne Way, eight miles from the Vesta Refinery, the upper end of the line. This cable worked perfectly for both telegraph and telephone work; among others who were attracted to Pittsburgh by the reported success of the cable, for the purpose of personal examination, and who are consequently well acquainted with the merits of this system, were Messrs. Frank L. Pope, of this city, W. H. Eckert, General Manager of the Metropolitan Telegraph and Telephone Company, of this city, W. D. Sargent of the Brooklyn Telephone Company, T. D. Lockwood, Electrician of the American Bell Telephone Company, George T. Williams, Superintendent for many years of the Western Union Telegraph Company, Cincinnati district, Professor Dolbear of Boston, Superintendent J. Elliott Smith of the New York Fire Department, Professor John Barrett, City Electrician of Chicago, Henry Metzgar, General Manager of the Pittsburgh Telephone Company, and David M'Cargo, General Superintendent of the Allegheny Valley Railroad. This cable was laid in the ground without box or other protection, and has suffered considerable damage at the hands of the natural gas pipe men.

"With the kind indulgence of the Commission, I will read extracts from some letters on the subject of our Washington system. Colonel A. F. Rockwell, in his report to General Newton, after describing the Waring system, says: 'These tests and experiments have been numerous and thorough; they were conducted during a considerable period of time and by a large number of persons The detailed results, interesting and important, are embodied in the various letters which accompany this report and to which especial attention is invited. Their weight and value will be duly estimated, not only by the scientific attainments, but by the practical experience of some of the writers. From their consideration, and from my own observations and frequent participation in the tests and practical working for both telegraph and telephone purposes, I express the opinion that the cable laid by the Standard Underground Cable Company fulfills all the requirements of the service as an efficient and practical substitute for the present over head system.'

"The insulation remains perfect on *all* the conductors in the Waring Anti-induction Cables laid for my Department in the fall of 1883, and the entire system works as well as could be desired for both telegraphic and telephonic service. In fact, I have found your cable better adapted for municipal telegraph and telephone service than any other form of cable I have yet seen, for the reason that it may be looped to and from any given point as successfully as air lines. I have been in the service constantly since the summer of 1868, and in all this experience have not used any system of wires so thoroughly reliable as I find this cable to be.—HENRY R. MILES, General Superintendent, Telegraph and Telephone Service, District of Columbia, Washington, D. C.'

"We have, during the past summer, laid in Pittsburgh for the Bell Telephone Company there, more than two hundred miles of wire, and in Chicago, for the Bell Company of that city, nearly as much more."

Question, by Mr. Shelbourne—"Was the cable laid for those two companies, of the bunched style or anti-induction?"

Answer—"That laid in Pittsburgh was of both kinds, and in Chicago we used all bunched cable. The Washington cables were all of the Waring Anti-Induction pattern."

To the Commission—"As a result of over four years' work, we have cables working to day, and working successfully, in Pittsburgh, Washington, Philadelphia, New York, Chicago and Milwaukee. The company is willing to guarantee all work, and its guarantee is as good as a United States bond."

Nebraska Telephone Business.

The business of the Lincoln, Neb., Telephone Exchange is in a prosperous condition and constantly on the increase, and the fact that such is the case is one of the numerous indications that can be seen on every hand pointing to the growth, prosperity and increased business of that enterprising city. In a talk with Manager A. P. Fair your correspondent learned that on the first of October there were in operation in the city 370 telephones. This is an increase of seventy-five since the first of January last, and the largest increase ever made in the same length of time. The office force consists of four young ladies and four boys, and besides this, the company constantly employs three line repairers and the manager. At present, however, the company is putting in some new work, and this is being done by the superintendent of construction, who travels around from town to town wherever his services are needed. He has a force of nine men now employed in this city. The new work consists of the erection of a line of forty-five foot poles with a capacity of something over a hundred wires on O street, between Thirteenth and Sixteenth. This was found necessary to relieve the Eleventh street line, which is already overcrowded, and will be used to serve patrons living in the southeastern part of the city. The line runs out as far as Twenty-seventh street, sending off innumerable branches along the way, and ultimately it will be necessary to put in the large-sized poles for the entire distance. Some time since the company established a messenger system to do the work which is handled in the larger cities by the district messenger service. This, however, has not been as complete a success as it could have been made, and, as Manager Fair intimated, the failure has been in a large degree due to the fact that it has not been advertised. The company has had constantly in its employ, however, a boy to do all kinds of errands, but it is doubtful if any considerable portion of our citizens are aware of the fact. This is an industry that ought to be made a success in a city of the proportions of Lincoln, and if it was properly kept before the public it no doubt would be.

The Nebraska Telephone Company, of which the Lincoln exchange is a branch, now operates exchanges in twenty-three towns in eastern Nebraska, and within a short time will control the exchanges at Nebraska City and Hastings. Besides these they have connections with forty-five towns in western Iowa operated by another company.

Fremont is at present the farthest point west on the Union Pacific road reached by the company, but the superintendent of construction, who is at work in Lincoln, leaves in a few days to build a line from that point to Columbus, forty-five miles, and that town will then be added to the list. This line will be built in the most substantial manner, and of copper wire. Heretofore the company has used steel or iron wire for all outside work, confining the use of the more expensive copper material to lines within the city. Hereafter, however, the copper wire will be used for outside as well as inside work, adding very materially to the efficiency of the service.

The Telephone Business in South America.

The Tropical American Telephone Company, Limited, of Boston, owns the exclusive right to sell, lease and use the "Bell" telephones, Blake transmitters, and all other telephonic apparatus manufactured by the American Bell Telephone Co. in the entire territory of South America, Central America and West Indies, acquired from the Continental Telephone Company. The Tropical Company issued a circular this month showing the financial condition of the company, July 1st—the end of the fiscal year—to be as follows:

QUICK ASSETS.

Cash in bank and on hand	$21,230 79	
Due from sub-companies	18,915 39	
Furniture	375 00	
		$40,521 18

DEBTS.

Accounts payable	$2,747 11	
Notes "	2,800 00	
	$5,547 11	
Due Continental Telephone Co., in cash	5,841 92	
Due West India Telephone Co., in supplies	372 65	
		$11,761 68
Excess of quick assets, 79c. per share		$28,759 50

OTHER ASSETS—SUB-COMPANY STOCKS.

4,000 shares Inter-Continental Telephone Co., @ $1.50	$6,000 00
3,000 shares West India Telegraph and Telephone Co., @ 50c	1,500 00
105 shares West Coast Telephone Co., say	1,000 00
50 shares Companhia Telephonica, Brazil	2,500 00
470 Companhia Nacional de Electricidade	35,250 00
	$46,250 00

CONTINGENT ASSETS.

One-half proceeds certain notes in Brazil	$2,500 00
Supply contract with Companhia Nacional, Brazil	50,000 00
Supply contract with Inter-Continental Telephone Co	4,000 00
Supply contract with West Coast Telephone Co. Supply contract with Commercial Telephone Co Supply contract with Barbadoes Telephone Co.	2,500 00
	$59,000 00
Total, say, $3.71 per share	$134,000 50

Treasury stock, unissued, 3,882 shares.
Dividends paid January 15 and July 15, 1885, $8,000.

The Tropical American Company will this week divide one-half of its capital stock among shareholders of the Continental Telephone Company, and also two shares of International Bell Telephone Company, Limited, for every five shares of Continental Telephone Company.

—— The Brooklyn Bridge Trustees, at their last meeting, decided to enlarge the electric-light plant by the addition of a 10-light dynamo and a 16 horse-power stationary engine, at an expense of $10,000. The United States system is used.

ELECTRIC LIGHT NEWS

—— During the last six years, 6,000 dynamo-electric machines have been constructed in Germany as well as 20,000 arc lamps.

—— The New Bedford Electric Light Company has made a contract with the Jarvis Engineering Company of Boston for engines and boilers.

—— Mr. Arthur W. McLaughlin, who represents Holmes, Booth & Haydens in the leading Western States, is in New York conferring with his company and getting points on new business. Mr. McLaughlin has a wide acquaintance and secures excellent returns for his large house in the territory he represents.

—— The Cyclorama of the battle of Gettysburg, in Philadelphia, was opened last Monday. The building is lighted with electric light of the Ball system—forty lights. The steadiness and brilliancy of the lights were very fine, and the installation was pronounced a success. Col. H. M. French, as general agent, is doing excellent work for the Ball Company.

——In New Haven the demand for electric light is steadily increasing, and the New Haven Electric Company of that city have found it necessary to increase their plant from 200 to 350 arc lamps. The Armington & Sims Engines are used exclusively. For the past year, both the Jarvis and the common settings have been used for the boilers, but in making the extension of their plant, the former will be employed.

—— Some of the prominent residents of Ingram, P., C. & St. L. R. R., have organized a light company, which is called the McCormick Illuminating Company. They have erected 19 lamps from the station to the ridge on Prospect avenue. The company is composed of about twenty of the residents, who pay for the light themselves. Mr. Newton Petrie is President and J. J. McCormick is Secretary.

—— Messrs. Stout and Meadowcroft have recently completed an original and beautiful electric-light design for Mr. Edward H. Johnson, an enterprising and appreciative citizen of New York. An expensive and capacious holder of flowers is so arranged that a number of six-candle incandescent lamps are concealed by the flowers and foliage when put in, and when placed on the parlor or dining table, and the current turned on, the effect created by the soft yet brilliant light is surprisingly beautiful. The idea of combining the incandescent light with the effect of flowers and foliage is a very happy one.

—— A broken electric-light wire at State and Harrison sts., Chicago, became connected on Friday night with an iron pillar. This passed the electric current along a hand railing, and it, returning by another railing, made a complete circuit. A negro came along and leaned wearily against the railing. Then he bristled up with energy. His arms were closed around the railing and his body was bent like a letter S. He had no idea what was the matter with him, and being unable to let go his hold, cried out loudly that he was dying. A dozen men ran to his assistance and were soon experiencing the tingling effect of the electricity. Some laughed, others cried, and many called for help. A crowd soon gathered, and a few additional victims were hanging to the railing. Finally the crowd numbered nearly 500. Cars were stopped and no one could get past. A police wagon arrived just as an enterprising man discovered the cause of the trouble and released the victims by disconnecting the wire. The police dispersed the crowd, everybody laughed and no one was arrested.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING OCT. 13, 1885.

327,997 Electric annunciator; Arthur E. Briggs, Bond Hill, Ohio.

328,012 Conduit for wires; Henry F. Cox, Philadelphia, Pa.

328,022 Electric arc lamp; Alexander L. Fyfe and John Main, Brixton, county of Surrey, England.

328,027 Structure designed to occupy the streets; R. G. Hazard, New York, N. Y.

328,030 Electric bolt-releasing device; George L. Henzel, San Francisco, Cal., assignor of one-half to Edward F. Henzel, same place.

328,055 Time signal transmitting system; John M. Oram, Boston, Mass.

328,148 Electric signal and call apparatus; Carlos A. Smith, Brooklyn, assignor of one-eighth to M. S. Frost & Son, New York.

328,156 Electric Temperature regulator; Chas. A. Tucker, Islip, N. Y.

328,205 Electric telethermoscope; Frederick W. Flint, Atlanta, Ga.

328,208 Galvanic cell; Ernest M. Gardner, Boston, Mass., assignor to James L. Little, Jr., same place.

328,253 Dynamo-electric machine; Edwin W. Rice, Jr., Lynn, Mass.

328,305 Telephone exchange system and apparatus; Leroy B. Firman, Chicago, Ill., assignor to the Western Electric Manufacturing Co., same place.

328,418 Current motor for dynamo-electric machines; William Main, Brooklyn, N. Y., assignor to the River and Rail Electric Light Co. of Ohio County, West Virginia.

328,420 Electrical railway; James F. McLaughlin, Philadelphia, Pa., assignor by mesne assignment to the National Electric Railway system, same place.

328,447 Apparatus for utilizing the current force of water; Edwin L. Brady, Stamford, Conn., assignor to the River and Rail Electric Light Co. of Ohio County, West Virginia.

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"Among the different systems of arc lighting may be mentioned the Brush, the Weston, the Schuyler, the Thomson-Houston, and the Fuller-Wood (hereafter to be known as the American). The Fuller-Wood system of arc lighting has gained a world-wide reputation for reliability and economy. This organization was originally known as the Fuller Electrical Company, which dates its existence from 1878. This system was the foundation of the well-known Gramme Association, being the party of the first part in the articles of association, which was composed of the Brush, Weston, United States, Thomson-Houston, Edison and Joblacoff companies, which was good evidence that all the companies composing that association were willing to pay tribute to the superior merit of the Fuller Wood system.—*N. Y. Sun, Sept. 27th*, 1885.

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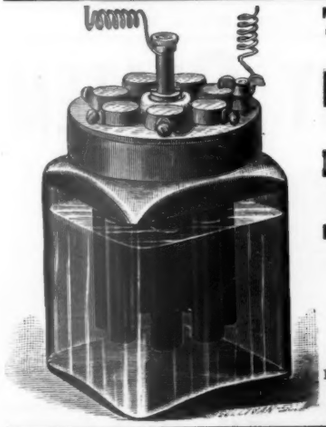

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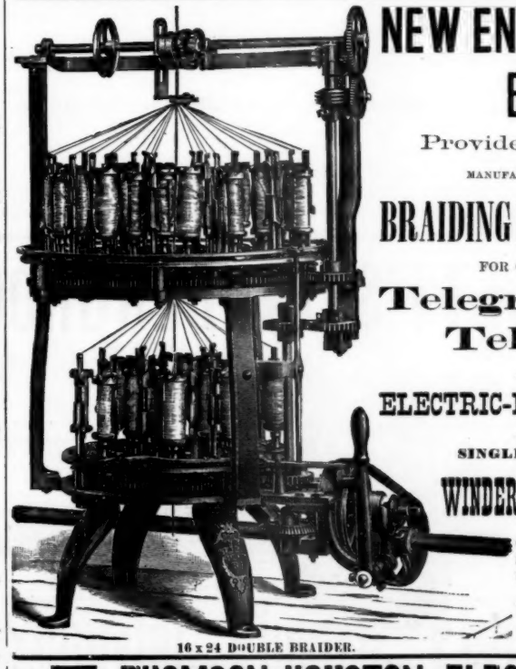

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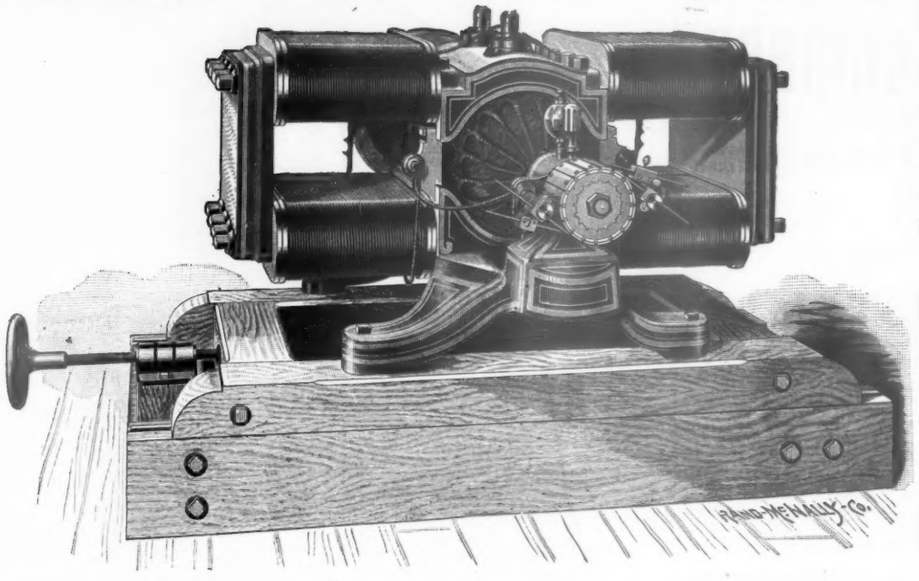

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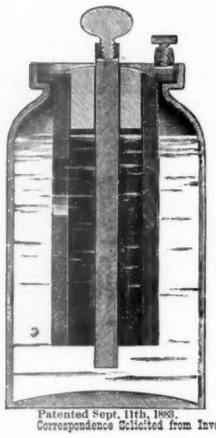

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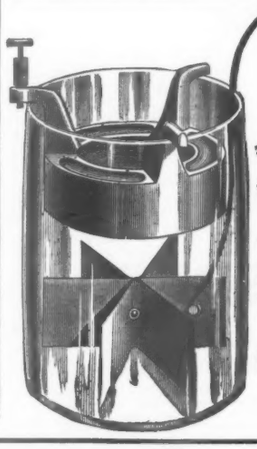

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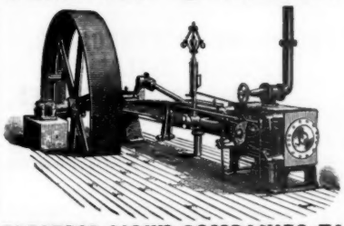

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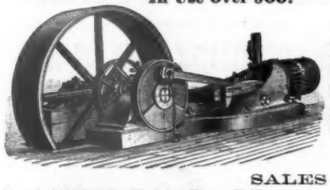

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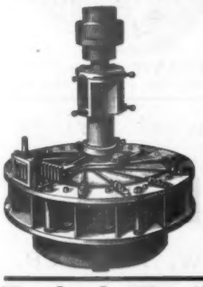

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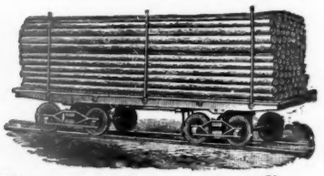

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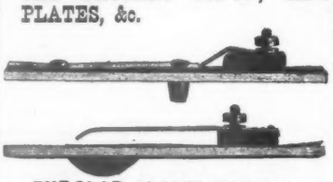

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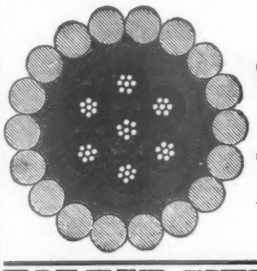

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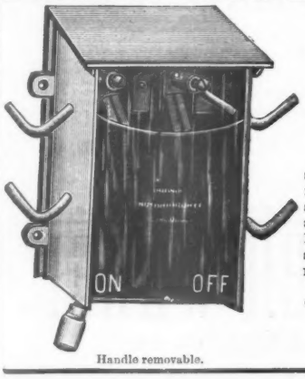

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United States Electric Lighting Co.
SOLE MANUFACTURERS OF
WESTON
DYNAMO MACHINES
FOR BOTH
Arc and Incandescent Lighting and Electroplating.
WESTON ARC LAMPS,
Weston Incandescent Lamps,
ELECTRIC MOTORS, AUTOMATIC REGULATORS,
Fixtures, Fittings, &c.
THE WESTON SYSTEMS OF
Arc and Incandescent Lighting
ARE SUPERIOR TO ALL OTHERS IN
EFFICIENCY, SAFETY, RELIABILITY AND
Perfection of Automatic Regulation.
Full information with prices and Estimates furnished upon application.
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OWNERS OF PATENTS COVERING THE ONLY COMPLETE ELECTRIC TIME SYSTEM, WHICH HAS BEEN SUCCESSFULLY OPERATED ON AN EXTENSIVE SCALE, IN THE WORLD.

THIS Company, recently organized, has acquired all the Patents and Contracts of the TIME TELEGRAPH COMPANY and a large number of valuable and entirely new base patents covering Electro-Mechanical Clocks and Synchronizing Devices. Two years of service in New York, Boston, Providence and other large New England Cities have demonstrated the perfect reliability of this System. Highest testimonials at the Philadelphia Electrical Exposition and from Electrical Experts and practical Clock Manufacturers and Dealers, also from subscribers who are using the System in 20 of the prominent cities of the United States.

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The reliability and durability of Kerite Insulation is unsurpassed, as has been proven by years of experience. All rubber and gutta-percha compounds are very short-lived when placed either in the air or underground, and the supposed new insulating materials now being presented to the public, are most of them old and discarded experimental products. The present high standard and uniform quality of Kerite is the result of 30 years' experience.

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THE SYSTEM COMPRISES:
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Cost of Apparatus Greatly Reduced. Surveys and Estimates Furnished by Experts.

☞ This company owns and controls all the Patents for ARC LIGHTING issued to CHAS. F. BRUSH, of Cleveland, for the New England States, New York, Pennsylvania, New Jersey, Delaware, Maryland, and the District of Columbia; also the Swan Patents for the same territory.

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THE BRUSH ELECTRIC CO.,

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WE FURNISH the ONLY COMPLETE and PERFECT SYSTEM OF ELECTRIC LIGHTING.

Machines for Arc Lighting, giving lights of 1,200, 2,000, 3,000, 4,000 and up to 100,000 candle power. Our No. 8 machine gives 65 lights of 2,000 c. p. with about 45 H. P.

Over twenty different styles of arc lamps, for indoor and outdoor use, and for tower lighting.

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adapted for use with Swan Incandescent lamps. These machines are automatic and do not require the use of any switches or resistances outside of the machine to govern the current. Will run any number of lamps from one up to the full capacity of the machine, without change of speed and without the use of any apparatus outside of the machine.

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Storage Batteries, for Incandescent Lighting and for Electric Motors. Our storage batteries are the only practical ones offered in the market. They are especially adapted for situations where lights are needed for only four or five hours per day and where it is convenient to use power during the day to store up the current. There are thousands of such places where our storage battery must eventually be used.

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Our carbons are the purest and best made. We have the largest and most fully equipped carbon factory in the world and our prices are very low.

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We have commenced the manufacture of the Brush Electric Motors and shall soon be prepared to fill orders for all sizes from one up to forty horse-power. In many locations these are the most economical producers of power and will be largely used by Lighting Companies and others where small powers are required.

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BARE AND COVERED, OF EVERY DESCRIPTION.

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AUTOMATIC CUT-OFF ENGINE.

For all purposes where power is required.

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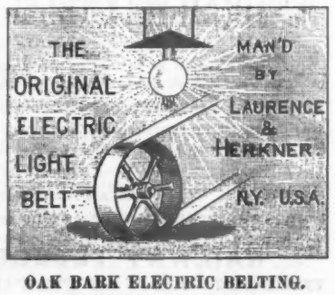

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